DOCUMENT RESUME

ED 419 950 CE 076 601

AUTHOR	Gamoran, Adam, Ed.
TITLE	The Quality of Vocational Education. Background Papers from the 1994 National Assessment of Vocational Education.
INSTITUTION	National Assessment of Vocational Education (ED), Washington, DC.; National Inst. on Postsecondary Education, Libraries, and Lifelong Learning (ED/OERI), Washington, DC.
REPORT NO	PLLI-98-8061
PUB DATE	1998-06-00
NOTE	202p.
PUB TYPE	Collected Works - General (020) -- Reports - Research (143)
EDRS PRICE	MF01/PC09 Plus Postage.
DESCRIPTORS	*Academic Achievement; Academic Education; Academic Persistence; Comparative Analysis; Curriculum; Educational Attitudes; Educational Legislation; *Educational Quality; Employment Patterns; Federal Legislation; High Schools; Higher Education; Knowledge Base for Teaching; Literature Reviews; Longitudinal Studies; *Noncollege Bound Students; *Outcomes of Education; Tables (Data); Teacher Certification; Teacher Competencies; *Teacher Education; Teacher Qualifications; *Vocational Education; Vocational Education Teachers; Work Experience
IDENTIFIERS	*Carl D Perkins Voc and Appl Techn Educ Act 1990; Impact Studies; National Education Longitudinal Study 1988

ABSTRACT

This document contains five papers. "Vocational Teacher Education in U.S. Colleges and Universities and Its Responsiveness to the Carl D. Perkins Vocational and Applied Technology Education Act of 1990" (Richard L. Lynch) documents the trend toward decreasing enrollments in teacher training programs in virtually all vocational fields. "Occupational Experience as the Basis for Alternative Teacher Certification in Vocational Education" (Richard L. Lynch) establishes that occupational experience is an inadequate substitute for formal teacher preparation in vocational education. "Curricular Tracks and High School Vocational Education" (James A. Kulik) demonstrates that most of the difference between vocational and academic students' test scores is due to students' characteristics rather than the nature of vocational education. "The Impact of Academic Course Work on Labor Market Outcomes for Youth Who Do Not Attend College: A Research Review" (Adam Gamoran) documents the importance of a solid foundation in basic academic skills. "The Effect of High School Vocational Education on Academic Achievement Gain and High School Persistence: Evidence from NELS:88 (National Education Longitudinal Study of 1988)" (Kenneth A. Rasinski, Steven Pedlow) suggests that the benefits of vocational education for high school completion may occur by improving students' success in courses. (MN)

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THE QUALITY OF VOCATIONAL EDUCATION

BACKGROUND PAPERS FROM THE 1994 NATIONAL ASSESSMENT OF VOCATIONAL EDUCATION

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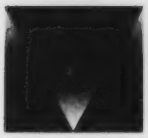

NATIONAL ASSESSMENT
OF VOCATIONAL EDUCATION

THE QUALITY OF VOCATIONAL EDUCATION

BACKGROUND PAPERS

FROM THE

1994 NATIONAL ASSESSMENT OF VOCATIONAL EDUCATION

Edited by Adam Gamoran
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National Institute on Postsecondary Education, Libraries, and Lifelong Learning
Office of Educational Research and Improvement
U.S. Department of Education

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June 1998

This study was funded by the Office of Educational Research and Improvement, U.S. Department of Education. The content does not necessarily reflect the views of the Department or any other agency. All references, tables, and figures were supplied as labeled by the authors.

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Richard L. Lynch is director of the School of Leadership and Lifelong Learning and Professor of Occupational Studies at the University of Georgia. He was formerly professor of vocational and technical education and site director for the National Center for Research in Vocational Education at Virginia Tech. Lynch's research examines vocational teacher education within a context of workforce education and teacher education reform.

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Introduction

As part of the Carl D. Perkins Vocational and Applied Technology Education Act of 1990, Congress mandated a National Assessment of Vocational Education (NAVE). This assessment was completed and presented to Congress in a five-volume *National Assessment of Vocational Education Final Report to Congress* in July 1994 (Boesel and McFarland, 1994; Boesel, Hudson, Deich, and Masten, 1994; Boesel, Rahn, and Deich, 1994; Hudson, 1994; Muraskin, Hollinger, and Harvey, 1994). To carry out the assessment, NAVE gathered a large amount of information from a wide variety of sources, including published and unpublished research papers, and new analyses of ongoing and original national surveys. Among the sources of information was a series of policy-oriented research papers commissioned especially for NAVE. These background papers furnished important support for the findings and recommendations issued in the *Final Report*. The present volume contains five of the NAVE background papers on the topic of the quality of vocational education. Dissemination of the background papers allows researchers and policy-makers to examine more closely the evidence on which the NAVE *Final Report* is based.

Each of the five papers in this volume played a role in shaping volume II of the NAVE *Final Report, Participation in and Quality of Vocational Education*. The two papers by Richard L. Lynch, "Vocational Teacher Education in U.S. Colleges and Universities, and Its Responsiveness to the Carl D. Perkins Vocational and Applied Technology Act of 1990" and "Occupational Experience as the Basis for Alternative Teacher Certification in Vocational Education," furnished some of the evidence presented in chapter 2 of volume II of the *Final Report Teachers in Vocational Education*. The paper by James A. Kulik, "Curricular Tracks and High School Vocational Education," and that of Kenneth A. Rasinski and Steven Pedlow, "The Effect of High School Vocational Education on Academic Achievement Gain and High School Persistence: Evidence from NELS:88," both contributed to the *Final Report* in chapter 5 of volume II *Educational Outcomes of Vocational Coursetaking*. Finally, a section of chapter 6 in volume II of the Final Report ("Employment Outcomes"), relied on Adam Gamoran's paper, "The Impact of Academic Course Work on Labor Market Outcomes for Youth Who Do Not Attend College: A Research Review."

Findings of the Background Papers in the Context of NAVE

How do the background papers in this volume fit into the broader context of NAVE? They address two topics covered in the *Final Report*: teachers in vocational education, and the outcomes of vocational and academic schooling. These two topics are only a small portion of the total NAVE; in fact they do not even cover all issues relating to the quality of vocational education, which also included assessment of program requirements and courses, employment outcomes of vocational education, employer involvement and satisfaction with vocational education, and other issues. The background papers in this volume provide detailed information on a range of topics that is relatively narrow compared to the full scope of NAVE.

Teachers in vocational education. One of the important findings Lynch reported in his first paper on vocational teacher education is that enrollment in teacher training programs in vocational education is declining in virtually all fields. This finding was highlighted by NAVE (vol. II, p. 75) in the context of a discussion of the vocational education teaching force. Elsewhere, NAVE also

reported declining enrollments of high school students in vocational courses (vol. II, p. 9). Although the decline in teacher education enrollment has been more rapid than the decline in high school student enrollment, a national survey of schools indicated that only a small proportion of schools have difficulty filling vacancies for vocational education teachers. NAVE concluded that "while one cannot discount the possibility that there may be vocational teacher shortages in the future, no systematic data suggest that this will occur" (vol. II, p. 79).

A highlight of Lynch's second paper on occupational experience as a basis for vocational teaching is the finding that occupational experience is not an adequate substitute for formal teacher preparation in vocational education. Although a few years of occupational experience may be helpful, many years of work experience do not contribute to teaching quality, whether measured by reputation, competency tests, or student achievement. Moreover Lynch found that the lack of background in pedagogy led to substantial problems in the classroom, although there were some exemplary programs in which such problems were mitigated. Largely on the basis of this evidence, NAVE advocated formal postsecondary education as a necessary component in the preparation of teachers for vocational education (vol. II, p. 80). NAVE also found that neither teacher education nor occupational experience were preparing teachers adequately to integrate academic and vocational education.

Outcomes of vocational and academic schooling. Kulik's background paper on curricular tracking and vocational education showed that although test scores of vocational and academic students differ widely, most of the difference is due to differences in the characteristics of students, not in the nature of the programs. Kulik found trivial achievement differences between students in vocational and general programs, while dropout rates are lower in vocational programs when student characteristics are taken into account. Although general-track students attend college more often than students from vocational programs, overall rates of participation in postsecondary education are about the same. These findings all contributed to the NAVE *Final Report* (vol. II, chapter 5).

Other evidence cited in NAVE (vol. II, chapter 6) uncovered employment benefits of vocational education, but generally these benefits accrue only to students who find jobs in fields that match their vocational training, and less than half of vocational graduates have such jobs. As a counterpoint to this research literature, Gamoran's background paper explored the labor market outcomes of academic courses and academic skills. Gamoran found that students who do not attend college obtain small benefits to wages from taking academic courses in high school, but the benefits may increase over the course of one's career. Academic course work also contributes to finding a job and to occupational status, but effects on annual earnings were inconsistent. Effects of academic skills showed a clear pattern of little or no benefits to wages immediately after high school, but increasing benefits over time. Moreover, better academic skills contributes to finding work shortly after high school. This evidence contributed to NAVE's conclusion that vocational graduates need a solid foundation in basic academic skills, and better integration of academic and vocational education would further this aim (vol. II, p. 156). Since skills have more substantial benefits than courses, students' progress should be measured in terms of skills rather than course work (vol. II, p. 155).

Rasinski conducted new empirical analyses that support and extend the reviews carried out by Kulik and by Gamoran. Using data from the National Education Longitudinal Study (NELS:88), Rasinski measured the impact of vocational and academic study during high school on academic achievement and on high school completion. Consistent with studies noted in Gamoran's

and Kulik's reviews, Rasinski found that academic courses contribute to student achievement (e.g., students who took geometry scored higher on the math test, etc.). Vocational courses generally did not contribute to academic achievement. However, participation in vocational education resulted in reduced likelihood of dropping out, just as Kulik found. Rasinski's analysis suggested that benefits of vocational education for high school completion may occur by improving students' success in courses. These findings figured in the conclusions of the NAVE *Final Report* (vol. II, chapter 5).

Contributions of the background papers to NAVE recommendations. The five background papers contained in this volume contributed to several of the major recommendations in NAVE's *Final Report* (vol. I). First, they support the overall recommendation that vocational education be maintained, but strengthened. Findings by Kulik and Rasinski that vocational education does little harm to achievement while reducing dropout rates contributed to this conclusion. Second, Lynch's findings about the teaching force contributed to the recommendation to implement higher standards for teachers in vocational education. Third, results reported by Gamoran on the labor market benefits of academic course work undergirded the recommendation for better integration of academic with vocational education. Fourth, Gamoran (among others) noted that educational attainment contributes more than course work to job outcomes, and this finding supported NAVE's recommendation that all high school vocational graduates have sufficient academic preparation to enter postsecondary education should they choose to do so. Fifth, information gathered by Kulik and by Gamoran supported NAVE's conclusion that the general track in high school offers little benefit and should probably be eliminated.

The background papers also raise questions for future research. Despite the broad scope of NAVE, important issues remain to be addressed, and new studies are needed to contribute to the continued improvement of vocational education in the United States.

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Vocational Teacher Education in U. S. Colleges and Universities, and Its Responsiveness to the Carl D. Perkins Vocational and Applied Technology Education Act of 1990

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Abstract

The primary purposes of this paper were to provide data and information about the preparation of vocational and technical education teachers at our nation's colleges and universities and about the responsiveness of vocational teacher education to four major initiatives in the Carl D. Perkins Vocational and Applied Technology Education Act of 1990. The extant research literature and a survey of institutional members of the University Council on Vocational Education provided the primary sources for the paper.

Colleges and universities have diminished greatly their capacity to produce teachers for the nation's systems of vocational and technical education. Further, there is little consensus on the theoretical framework for subject matter and related pedagogy for preparing 21st Century teachers to teach in vocational and technical education. Beginning teachers are being made aware of such major Perkins initiatives as tech prep, integration of academic and vocational education, school-to-work transition, and special populations. However, a solid theory and research base and the related connections with practice to undergird the initiatives and to bring about long-term, systemic change is probably not being provided at most colleges or universities.

The capacity of colleges and universities to produce teachers who are prepared to teach effectively all work-bound students for employment for the 21st Century workplace needs to be rebuilt. This includes determining the appropriate knowledge base for vocational and technical education teachers, core curriculum, minimal standards, new models of delivery, pedagogy, connections with practice, relationships necessary with academic and subject matter faculty and programs, and research and evaluation.

Background

If change is unsettling, these are indeed agitated times. Change and the resultant agitation are especially apparent as our nation's leaders and scholars debate the content and processes that must be in place to insure that American youth and adults are adequately prepared for realities of the modern workplace, contemporary society, and the international arena—now and in the future.

Literally scores of policy-oriented documents have been published in the last 10 years demanding that schools educate better *all* children, youth, and adults. The government (through the Carl D. Perkins Vocational and Applied Technology Education Act of 1990—Perkins II) has called for a different type of education and for redirected training programs to prepare our nation's students for the 21st century workplace. Many, many reform initiatives have been conceptualized, implemented, and (sometimes) evaluated in the public schools during the past ten years—often with mixed results (see, for example, Bottoms, Presson, & Johnson, 1992; Council of Chief State School Officers, 1991; National Assessment of Vocational Education, 1989; National Center on Education and the Economy, 1990; Secretary's Commission on Achieving Necessary Skills, 1992; William T. Grant Foundation Commission on Work, Family, and Citizenship, 1988).

Generally researchers and policy groups conclude that long-term sustaining, substantive changes will occur in public education only if implemented at the grassroots level—in local schools and by classroom teachers. But, too often, local personnel seem unable, unwilling, or insufficiently informed to make necessary changes. And thus, many recent education reform efforts have met with mixed results.

Recently, the Education Commission of the States placed "part of the blame" for the disappointing results of various education reform movements at the doors of colleges and universities that have failed to rehabilitate teacher training. This report as well as many others addressing education reform cite particularly the inability of teachers, school administrators, and other educational leaders (e.g., school boards) to negotiate curricular, pedagogical, and technological changes needed to bring about meaningful reform in public education. Scholars and observers of education say higher education institutions are not adequately preparing teachers (and school leaders) for change and are not addressing essential elements in school reform.

Similar comments emanate from state and local administrators responsible for vocational and technical education as they wrestle with the necessary changes underlying Perkins II. Commentary—often accusatory in tone—ranges from the nonresponsiveness of colleges and universities to reform initiatives in vocational and technical education, low production of vocational and technical education teachers, poor preparation of beginning teachers, aging of the professorate, and on and on and on.

Through the 1990 Perkins Act [Section 403—the National Assessment of Vocational Education Programs (NAVE)], Congress instructed the U.S. Department of Education's Office of Educational Research and Improvement (OERI) to conduct a national assessment of vocational education programs assisted under the Act. As part of the assessment, Congress asked for information about the preparation and qualifications of teachers of vocational and academic curricula in vocational education programs, as well as shortages of such teachers.

This paper has been prepared in partial response to the Congressional mandate to OERI. Its purpose is to provide data and information about the preparation of vocational and technical education teachers as it currently exists at our nation's colleges and universities. In addition, the paper provides information about the responsiveness of vocational teacher education in four major initiatives identified in Perkins II: (a) tech prep, (b) integration of academic and vocational education content and programs, (c) school-to-work transition and interaction with business and industry, and (d) work with special populations. Finally, the paper highlights a few issues that the author considers integral to assessment of vocational education, circa 1994.

Vocational Teacher Education at Our Nation's Colleges and Universities

Assumptions and Limitations of the Data

Data and information provided herein to inform Congress about vocational teacher education at our nation's colleges and universities are limited as follows:

This section of the paper focuses on vocational teacher education as it exists in our nation's colleges and universities, primarily at the preservice level. Programs sponsored by state departments of education, vocational teacher associations, and local school systems—such as inservice and staff development to initially certify trade and industrial teachers, induct new teachers, or upgrade the knowledge and skills of vocational education teachers—were not examined.

State vocational education certification policies, related requirements and regulations, and their impact on vocational teacher education at colleges and universities are not discussed in this report.

Nearly all states certify a considerable portion of their vocational education teaching force without benefit of professional education. Minimal requirements range from a high school diploma equivalent (i.e., completion of a GED) and occupational experience, to completion of some preservice and inservice workshops, to a master's degree (i.e., in some states and in some subjects). The impact of state certification on the design and delivery of vocational teacher education is unclear. Apparently, vocational teacher certification and college teacher preparation are developed and administered relatively independently in most states.

Data and information as published in extant literature served as the framework for data reporting and the basis for analysis found in this section of the document. Original data were not collected for purposes of this section.

Data from the extant literature reported herein were not collected nor reported in a systematic, consistent way among the various studies, by various authors, and in various subject areas cited in this report. Thus, the reader is advised to interpret data cautiously.

Introduction

It is not easy to determine exactly how many U.S. colleges and universities actually offer programs to prepare teachers of vocational and technical education. A primary reason for this difficulty is that the words, vocational teacher education, are not always the descriptors used to identify such programs. Rather, programs are more apt to be called by their subject-specific names (e.g., agricultural education, business education, home economics education). The problem is compounded in that there is no nationally published directory identifying *vocational* teacher education programs.

A second reason is that programs that do exist are administered in very diverse units on our nation's college and university campuses. For example, agricultural teacher education might be administered in the college of agriculture, business education in the college of business, and technology education in the college of education—all on the same campus. An even more serious problem is that there is no agreed-upon conceptual framework or knowledge-base related to education for the workplace and workforce development that professionals or professional associations have codified as important in the preparation of teachers for secondary, postsecondary, or

adult vocational and technical education programs. Thus, there does not seem to be a strong sense of *professional* identity with a body of knowledge and a discipline related to vocational teacher education.

Rather, vocational teacher education programs still tend to be organized by programs identified specifically and historically in vocational education legislation; that is, by those in the Smith Hughes Act of 1917 (agricultural education, home economics education, and trade and industrial education) and subsequent federal legislation (distributive/marketing education, industrial arts/technology education, business education, health occupations education, and vocational special needs).

Accumulative data and analysis from current studies about teacher education in these various subject-specific programs indicate that significant change is warranted in vocational teacher education if various education initiatives identified in Perkins II, and with concomitant educational reform efforts are to be realized. At the national or macro level, all of these traditional, subject specific programs have suffered steep enrollment declines and/or the teacher education faculty have been eliminated or downsized resulting in tremendously diminished capacity to produce teachers for our nation's systems of vocational and technical education. There are many reasons for this, chief among which is the loss of federal and state funds. "Stand-alone," single-subject specialized vocational teacher education programs in colleges of agriculture, home economics, business, or technology have been particularly vulnerable to reductions and closing. Programs in colleges of education and those administered jointly with other vocational teacher education programs have tended to fare better.

The (former) teachers of vocational education teachers are still gainfully employed in colleges and universities, but often as faculty of technical subject matter, cooperative extension specialists, or in training and development. Those who remain primarily in teacher education, typically instruct relatively lowly enrolled classes in subject-specific pedagogy and spend 24 percent of their time in service-related activities. In 1989, the vocational education professorate was middle aged and had been working in higher education for 16 years.

There is some evidence—mostly perceptual in tone—that the decline in teacher education has resulted in a shortage of vocational education teachers or will result in a shortage in the near future. Regardless of supply and demand factors, the evidence does seem fairly strong that recent vocational teacher education graduates are not adequately prepared for the realities of contemporary vocational and technical education programs. The following is a synthesis of relevant studies.

The Universe: Colleges and Universities With Programs

Vocational Teacher Education. By creating a matrix from subject-specific directories of teacher education programs (i.e., for agriculture, business education, home economics education, etc.), Lynch (1991) reported vocational teacher education exists in some form at 428 colleges and universities in the 50 states, Puerto Rico, Guam, and Washington, DC. This is approximately one-third of the more than 1,200 American colleges and universities which have the preparation of teachers as one aspect of their mission.

For the most part, vocational teacher education continues to follow a traditional specialized-subject model. According to information published in 1988–89 program area directories, there were 90 teacher education programs in agricultural education, 236 in business education, 32 in

health occupations education, 268 in home economics education, 89 in marketing education, 176 in industrial arts/technology education, 122 in trade and industrial education, and 98 in vocational special needs (Lynch, p. 191).

Upon closer review, however, Lynch found these numbers to be considerably inflated. Several colleges and universities—at least 10 percent—had closed their vocational teacher education programs. Many other programs hadn't graduated vocational education teachers in years. Some college officials responded that they didn't really have vocational teacher education programs, and they didn't consider the preparation of such teachers to be part of their mission.

Further, although faculty at many institutions had at one time engaged actively in vocational teacher education—and many continued active affiliation with the field—their assignments over the years had shifted into other areas (e.g., teaching technical content courses, administration, service activities). Thus, the [former] teacher educator(s) was still at the university, listed in the teacher education directory for that vocational education subject area, and active in his or her vocational teacher education professional association; however, the program was in fact dormant or nonexistent.

Lynch (1991) did find that about 100 U.S. colleges and universities offer four or more vocational teacher education programs on a single campus; thus, implying that vocational teacher education was integral to the mission of that college or university. Many of the remaining 300+ programs listed in directories are staffed by a single faculty member (often at less than 1.00 full-time equivalent in teacher education) in one program (e.g., a home economics teacher educator) or a small cluster of faculty who work with prospective teachers in a technical program area (e.g., technology education teacher educator(s) working with prospective teachers—among other majors—in a school or department of technology).

Subsequent reviews indicate that these single-subject programs produce few teachers in any given year. Further, the small number of teacher educators in these programs and their isolation from other pedagogists preclude preparing students in a broadened conceptualization of vocational education (e.g., in integrating vocational and academic education, tech prep, workforce and workplace generic and specialized skill development) which might extend beyond that of their subject-specific area. In general, these subject-specific programs are far better known for their technical preparation than they are for teacher preparation. And, there is some evidence that as enrollments declined in teacher education, program faculty shifted their instructional assignments into non-teaching options (Volk, 1993).

The following is a brief review of recent studies that have reported and discussed contemporary program and enrollment status in vocational teacher education programs. Evidence is abundantly clear that, at a macro or national level, enrollments in teacher education have declined significantly in most vocational subject-specific areas, programs have been eliminated, and that teacher educators—although still employed at the universities—have found work other than in vocational teacher education. Further, although empirical data are seemingly unavailable, the general conclusion is that there will be a shortage of teachers in most vocational subject areas in the future.

Agricultural teacher education. Interestingly, only one program in agricultural teacher education has been eliminated by a college or university in recent years, although most programs have small enrollments and few graduates. Oliver and Camp (1992) reported 89 agricultural education programs in 1991 compared to 90 in 1988 (Lynch, 1991). However, the authors noted that 10 of the 89 programs (11 percent) had zero graduates for the 1991–92 academic year.

The numbers of "newly qualified potential teachers of agriculture fell from 1,660 in 1975 to 625 in 1990," a 62 percent decline (p. 5). Oliver and Camp further reported that 266 agricultural teacher educators at the 89 colleges and universities graduated 312 teachers in 1991, for an average of 3.5 agriculture teacher graduates per institution and 1.2 per agricultural education faculty member.

Enrollments in public school agricultural education programs have declined by 25 percent since the late 1970s; however, the number of teachers of such programs declined by only 17 percent—although the number of teachers has declined steadily each year since 1979. In analyzing teacher demand with teacher supply, Oliver and Camp (1992) noted that there were jobs for only ten agriculture teachers on September 1, 1991 (p. 8). This information was based on survey data collected from all state supervisors of agricultural education in the country.

Oliver and Camp found that graduation from an agricultural education program no longer means certification to teach, rather agricultural education is regularly used as an umbrella degree for those choosing to enter such other occupations as agricultural extension or agricultural communications. Nearly 60 percent of agricultural education graduates do not teach in their first year after graduation. Based on this finding and the low salaries for beginning teachers, the authors concluded that "a serious shortage of teachers ... appears possible in the future" (p. 5).

Business teacher education. Business education appears to be particularly hit with program closing and teacher education decline nationally. Further, the end may not be in sight for eliminating more business teacher education programs. Luft and Noll (1993), in a survey of all 235 colleges and universities affiliated with the National Association of Business Teacher Education (NABTE), found that 34 percent expect their programs, within five years, to be "integrated with other teacher education programs, downsized, or eliminated" (p. 10). The authors also reported that 11 business teacher education programs had recently been eliminated [since 1986] and 16 were predicted to be eliminated within the next five years. In adding up the declines from NABTE surveys in a 10-year period (1980–90), business teacher education lost 25 percent ($N = 75$) of its programs and may lose up to another one-third (Kaliski, 1987; Luft & Noll, 1993; Schmidt, 1985).

This may be particularly troublesome since business education comprises the lion's share of the vocational teaching force—32 percent of high school vocational teachers and 24 percent of two-year college vocational faculty (*Vocational Education Journal*, 1991). Further, the high school business education teaching force is an aging one with 27 percent over age 50 and nearing retirement (Kaufman, 1992).

Anecdotal evidence and some data suggest that there may be a relationship between business teacher education decline and its administrative location on college campuses. Luft found that 50 percent of business teacher education programs were in collegiate schools of business—few of which have as their mission the preparation of teachers. An additional 18.5 percent were in colleges other than education. Contrary to reports of massive enrollment declines in business teacher education, Lynch (1991) found that the number of graduates from business teacher education programs had actually increased in the 3-year period from 1987–89. However, the business teacher education programs studied by Lynch (i.e., those which were among four or more vocational teacher education programs located at one university) tended to be in colleges of education and administered with other vocational teacher education programs. In effect, enrollment in some business teacher education programs may be increasing substantially—perhaps those in colleges of education—while programs are being eliminated at some colleges or universities—perhaps those in business schools.

Further, Luft and Noll (1993) report that enrollment declines at 38 percent of the business teacher education programs caused faculty to shift into teaching computer applications and other technical courses—at the expense of further developing or reforming teacher education programs.

Home economics teacher education. The numbers of programs in home economics teacher education have also declined throughout the past decades. The five year decline from 1984–88 was from 281 to 266, a 5 percent decline (Hall & Miller, 1989). The authors report data from another survey that indicate at least 22 percent of home economics teacher educators fear program closure or elimination in the future. It is interesting to note, however, that few programs of home economics teacher education have actually been eliminated relative to closings in business and technology teacher education, especially considering their steep enrollment declines (see, for example, Hall & Miller; Kellet & Beard, 1991; Lynch, 1991).

Lynch (1991) reported a 15.4 percent decline in graduates of home economics teacher education programs from 1987–89. Other, more longitudinal program specific enrollment data show steeper declines than reported by Lynch. For example, Kellett and Beard (1991) report that the mean number of graduates in home economics teacher education per institution in 1975 was nearly 27. Thirteen years later, the total enrollment in nearly all home economics teacher education programs was less than 20 students; at 41.5 percent of the university programs, enrollment was fewer than ten. The average number of university-prepared teachers annually for home economics programs was less than five per institution.

Similar to faculty in agriculture, business education, and other vocational subject areas, home economics teacher educators tended to shift assignments into other areas, for example, preparation of home economists, teaching consumer- and family-relations courses, and international education (Hall & Miller, 1989).

Much like agriculture and business education, home economics professionals are concerned about teacher supply. According to Kellett and Beard (1991), "a large percentage of home economics teachers will retire before the year 2000. Enrollment patterns and opportunities for employment raise concerns regarding an adequate supply of home economics teachers" (pp. 19–20).

Health occupations teacher education. Little is known about the preparation of teachers for health occupations, probably because there are comparatively few health occupation teachers in secondary vocational education programs (1.6 percent of the total secondary vocational teaching force). Also, many health occupations teacher preparation programs are included with trade and industrial teacher education. Much like trade and industrial education, a considerable percentage of health occupation teachers come from industry (i.e., the medical professions) and are not prepared to teach through traditional teacher preparation programs. Pratzner and Ryan (1990) report that 50 percent of beginning health occupation teachers had not completed a baccalaureate degree.

Lynch (1991) found only 32 colleges and universities nationally that purport to offer teacher education in health occupations and only 12 of these offer preservice programs. From 1987–89, enrollment in these 12 programs was stable, averaging about 6 graduates per year.

Industrial arts/technology, industrial, and technical teacher education. The teacher education component of "single-subject" trade, technical, industrial programs (whatever the nomenclature) and industrial arts or technology education programs has declined considerably. McAlister and Erekson (1988) report that most university faculty hires in trade and industrial education and technology education are to teach in technical areas (Computer Aided Design/Computer Aided Mapping, manufacturing, technology) and not in teacher education. These authors indicate the

shift away from teacher education programs in technology and industrial education was a result of a desire "to continue enrollments, while serving a new diversified population with different career goals" (p. 47).

Oaks and Loepp (1989) report that 30 technology-based teacher education programs (14 percent) were terminated at colleges and universities between 1979 and 1988. Volk (1993) comments that the terminations along with those that produce no teachers, result in a real decline of 24.1 percent. Oaks and Loepp fear that if the closing trend continues, a resulting teacher shortage will "surely prove to be a serious problem for the technology education profession" (p. 67). Volk goes even further by speculating that if the enrollment decline continues at its present pace, "the demise of the profession will occur near the year 2005" (p. 57).

There is some evidence that there may be a cause and effect between programs that shifted from teacher education into non-teaching options. The non-teaching option, in effect, "took over." For example, Volk (1993) notes that the 20-year rate of decline for industrial arts/technology education majors was 69.7 percent; concomitantly the non-teaching degrees increased by a whopping 790.0 percent. "This latter increase was due in great part to the explosive growth and shift in emphasis to industrial technology program options" (p. 50). Further, Volk found teaching options at colleges and universities were much more apt to be eliminated when industrial (non-teaching) options were provided.

Marketing education. Ruhland (1993) reports that only 56 institutions currently offer an undergraduate degree in marketing education or provide marketing education certification courses. This represents a 37 percent decline (since 1989) in the number of colleges and universities which purport to offer specialized programs in marketing teacher education. Further, five of the 56 institutions offer only state-required marketing teacher certification courses in contrast to a bona fide program or major in marketing education and five report no graduates. Three additional programs are being phased out in the next three years and an additional three will combine business and marketing teacher preparation programs. In reality, therefore, there are about 40 marketing teacher education programs which annually graduate at least one or more marketing teachers.

Enrollments, too, from all university marketing education teacher supply sources (baccalaureate, certification option, graduate) declined by 38 percent in the 10-year period, 1982–92 (Lynch 1984; Ruhland, 1993).

In contrast to some other vocational teacher education programs, Ruhland (1993) did not find nor predict a shortage of secondary marketing teachers. [She presented little data about postsecondary teaching.] She attributes this primarily to the facts that "new secondary marketing education programs were not being developed, and programs were remaining as single teacher programs versus multiple teacher programs" (p. 22).

The effects of decline in marketing teacher education may be similar to that postulated for business education. That is, Lynch (1991) found a slight increase in teacher education enrollment in marketing education for the 3-year period, 1987–89, and, similar to business education, those enrollment increases were reported from programs primarily administered in colleges of education and with other vocational teacher education programs. Also, program closings in marketing teacher education were often those administered in collegiate schools of business.

Trade and industrial education. The preparation of trade and industrial education (T&I) teachers deviates considerably from that of other vocational education teachers. This is primarily because, (a) the vast majority of T&I teachers lack the baccalaureate degree—at least at the time they enter the classroom as teachers, and (b) "the teaching content and methodology of T&I programs vary markedly from other vocational education programs" (Duenk, 1989, p. 2).

Beginning with the federal 1917 Smith-Hughes Act and continuing to the present time, nearly all states substitute years of work experience rather than college preparation for certifying T&I teachers. In fact, only Hawaii and Wisconsin require the baccalaureate degree for initial certification as a T&I teacher. Seven states require a baccalaureate degree and five states require an associate degree for full certification. Beginning teachers in 43 states may teach in T&I programs without any college credits (Duenk, 1989). Pratzner and Ryan (1990) report that 73 percent of beginning T&I teachers do not have a baccalaureate degree. They note that most states do require from 16 to 200 clock hours of initial pedagogical preparation concurrent with the first year of teaching. Typically, this preparation is obtained through workshops or courses that are "provided by the state department of education, a college or university, or the school system itself" (Lynch & Griggs, 1989, p. 9).

In effect, vast numbers of T&I teachers initially and continually teach in public schools and technical institutes without benefit of any formal teacher preparation from a college or university. Thus, data about and from T&I teacher education programs at colleges and universities could be misinterpreted, since a relatively small percentage of that program's teaching force enter into it at the preservice level. Lynch (1991) did identify 122 T&I teacher education programs nationwide and a very slight enrollment increase (2.2 percent) over the 3-year period, 1987–89.

[More data, information, and related discussion are included later in this section of the paper under the subheading, "Preparation of Nondegreed Vocational Education Teachers."]

Vocational special needs. There is insufficient evidence in the literature to discuss meaningfully programmatic and enrollment data in preservice programs to specifically prepare teachers to teach vocational students with special needs. Lynch (1991) reported 98 colleges and universities purport to offer programs in vocational special needs with a 3-year average enrollment increase of 14.3 percent. However, few institutions provided specific data about the curriculum and structure of preservice (e.g., undergraduate) programs. It is therefore assumed that (a) a major in vocational special needs education is typically not available at the undergraduate level, (b) instruction in teaching vocational students with special needs is included as part of the professional preservice preparation of all subject-specific vocational education majors, and (c) extensive professional preparation for vocational special needs teachers is provided primarily at the graduate level.

Comprehensive vocational education. Studies previously reported have primarily been conducted and reported by researchers in and for subject-specific areas generally thought collectively as vocational teacher education. Some attempts have also been made to collect enrollment and programmatic data for all vocational subject areas in colleges and universities known to have several vocational teacher education programs.

Lynch (1991) collected data from universities with four or more vocational teacher education programs in the spring of 1989. Nearly 80 colleges and universities provided data on all of their vocational teacher education programs. Lynch found enrollments in undergraduate programs in vocational teacher education had declined overall from 1987 through the 1989 graduating class. Agricultural education and home economics showed especially steep enrollment declines, while technology education showed a slight decrease and trade and industrial education, marketing education, and business education showed modest increases. The largest percentage increase in enrollment was in the preparation of vocational special needs teachers.

Since July of 1985, the University Council for Vocational Education (UCVE) has published three reports and has one in press on the status of vocational teacher education in its member institutions. UCVE is currently comprised of 20 member institutions (see appendix A), all of

whom provide research, service, teacher education, and advanced graduate study in vocational and technical education. All UCVE member institutions offer a doctoral degree in vocational education and all but one are at land-grant universities.

Until the latest report, most UCVE institutions reported reduced demand for vocational teacher education courses (including graduate courses) both on- and off-campus on a biennial basis since the mid-1980s. However, in the latest report, which included the two academic years of 1990–91 and 1991–92, enrollments in undergraduate, master's, and doctoral programs were reported on the upswing (Anderson, in press).

Undergraduate enrollments increased to an average of 237 per institution (an increase average of 66 students per campus, 28 percent). Only three universities experienced a decrease in undergraduate enrollment during the two-year period.

Similarly, enrollments in both master's and doctoral programs increased. Mean numbers of master's students enrolled per institution increased from 111 to 129 (14 percent) in two years; only 4 institutions experienced declines in master's degree enrollments. [Two did not report data and five reported no change.] Doctoral enrollments increased from an average of 56 per institution in 1989–90 to 82 (32 percent increase) in 1991–92. Four universities reported decreases in their doctoral programs and six essentially had no change. Also, and for the first time since 1987, the number of full-time faculty in vocational education per institution increased—possibly due to increased grant and contract funding.

It should be noted that this latest report shows significant improvements over the three previous biennial reports. Throughout the 1980s, Anderson (1991) reported that the average number of enrollments, full-time and part-time faculty, support staff, and graduate assistants declined significantly at member institutions. However, it also needs to be noted that in his latest report (in press), Anderson provides no evidence that increased enrollments and numbers of faculty are in vocational teacher education programs. In fact, the increases reported may well be a result of vocational education units expanding their courses and program offerings into non-teaching areas (e.g., training and development, cooperative extension, industrial technology).

The Professorate

Little is known about teachers of teachers in our nation's colleges and universities and even less is known about teachers of vocational education teachers. Some demographic and other data have been collected about teacher educators (e.g., the American Association of Colleges of Teacher Education and the Center for Educational Renewal); however, data have not been (and cannot be) segmented out for vocational teacher education.

Based on a national survey completed by 633 preservice vocational teacher educators at 78 colleges and universities in 1989, Lynch (1990) summarized the profile of a typical vocational teacher educator as follows:

> The overall composite—or profile—of the vocational teacher educator is that he is a white male, probably a full professor, tenured, and 49 1/2 years old. If indeed he is a full professor, he earned $43,030 for 9 months employment in 1989; this is contrasted with a national average salary of $35,745 for vocational teacher educators, all ranks, both genders, 9 months employment. He completed a doctoral degree in vocational education 14 years ago—perhaps from Ohio State University.

> Vocational teacher educators have the equivalent of about 4 1/2 years of paid employment in at least two positions in business and industry. They accumulated 5 1/2 years experience as a secondary teacher and either full- or part-time experience as an adult education instructor. The typical teacher educator has been worked in higher education for 16 years; 13 at the college or university where presently employed.
>
> Vocational teacher educators tend to be very busy, spending 50 hours each week on the job; 58 percent of the time in teaching, 24 percent in service, and 18 percent in scholarship. Vocational teacher education faculty spend considerably more time in teaching and service activities and considerably less time on scholarship than either they or their university desire; their university particularly would prefer more time spent on scholarship. A vocational education teacher educator typically teaches three undergraduate and two graduate vocational pedagogy courses each year. It is also likely that they teach subject matter courses.
>
> Apparently, the profiled professor likes his job; he plans to remain in it, at least for the next five years. Eleven percent are planning retirement within five years. (pp. 6-7)

Salaries for faculty at doctoral-granting units affiliated with the University Council on Vocational Education were considerably higher than those reported in the broader data base by Lynch. For example, the average salaries of full professors of vocational education at 22 UCVE-affiliated universities in 1989 was about $2,000 more ($45,077) than the average salary reported by professors at 78 universities in Lynch's survey. Anderson (in press) recently provided more current data on the salaries of vocational education faculty at UCVE-affiliated universities. In 1991–92, full professors, 9 months employment, both genders averaged $51,554; associate professors averaged $41,015; and assistant professors averaged $32,005.

There are minimal subsequent data to describe further or segment out the vocational teacher education professorate. Some authors in some specific subject areas and speakers at conferences have predicted a larger percentage of retirees or resignations and a resulting need to fill vacant university positions. Some have claimed the professorate to be much older and (apparently) less wiser and experienced. However, data are not provided to support these claims.

Financing Vocational Teacher Education

Colleges and universities with vocational teacher education programs have been hard hit with financial downsizing over the past several years. From 1989–90 to 1991–92, nearly every UCVE-member institution experienced declining university and/or state financial resources (including federal flow-through dollars) for vocational education units. University financial support decreased at 14 of 20 UCVE-affiliated institutions and remained essentially unchanged at 6. State support was similar, although one institution reported increased state support and 6 reported no change; however, the remaining 13 reported significant decline in state financial support. Interestingly, support from research contracts and grants increased at 9 institutions during the same time period, decreased at 5, and remained unchanged at 6 (Anderson, in press). It is assumed that this increase in grant and contract work was to provide service activities and technical assistance to local school systems and state departments of education on Perkins II initiatives.

There is considerable anecdotal evidence that universities were hit particularly hard with funding cuts. One unpublished study identified 6 major, land-grant, research-oriented universities where vocational education units had experienced extraordinary stress due to financial cutbacks and resulting restructuring and reallocation of funds. Vocational teacher education and graduate programs were rumored to be completely eliminated at all six. In the 6-case analysis, the clear conclusion was that loss of federal funds from the Perkins legislation, which under prior legislation had trickled down from the federal to the state to the university, had severe negative impact on vocational teacher education at these 6 institutions. The epilogue to the study is that vocational education programs were eliminated at two, significantly downsized (and restructured) at three, and undergraduate programs virtually eliminated at one. Similar, but undocumented, tales surface regularly at conferences and meetings of vocational educators. In virtually all articles examined for this data review and in written and telephone communications related to this report, the decline of (federal and state) financial support was always cited as a major reason for the downsizing or elimination of vocational teacher education.

Dykman (1993) citing an interview with Lynch and others in vocational education commented that at least one-third fewer vocational teacher education programs exist today than in 1989. Further, even at universities that have retained vocational teacher education, many have phased out some programs, eliminated faculty positions, consolidated courses, transferred some programs to other colleges, and refocused priorities. In addition to the elimination of federal and state funding support for vocational teacher education, other reasons given for downsizing and eliminating programs were:

- low enrollment in teacher education;
- declining secondary school vocational enrollments;
- sluggish national economy and related university budget cuts;
- misunderstanding of vocational teacher preparation by deans of colleges of education;
- infighting among vocational disciplines;
- removal of certification requirements for postsecondary instructors;
- unfair image of vocational education; and
- low teaching salaries that turn off potential students. (p. 24)

There is some evidence that vocational teacher education programs administered in colleges of education receive greater financial support. Bott (1988) concluded that "in areas such as budgets, [programs of vocational education] in schools of education receive more support than programs in schools of engineering or technology" (p. 40). Budgets included amounts for graduate assistants, travel, and faculty members. Interesting though, is that despite lower budgets than might be received if they were in a school or college of education, department chairs preferred to remain in a non-education unit for purposes of perceived status and "higher quality" (p. 39).

Preparation of Vocational Education Teachers

According to Pratzner and Ryan (1990) "The formal preparation of vocational teachers has not followed a single track or approach. However, almost all states require prospective public vocational teachers to have from 3 to 6 years or more of full-time significant occupational experience prior to teaching" (p. 785).

In general, most vocational education teachers—secondary and postsecondary—have at least a bachelor's degree, some education courses, and occupational experience. However, when segmented, 73 percent of beginning trade and industrial (T&I) teachers and 50 percent of beginning health occupations teachers do not hold a baccalaureate degree (Lynch & Griggs, 1989). Rather, these vocational teachers are credentialed in their respective states to teach as a result of some significant amount of occupational experience (usually 3 to 6 years) in a particular trade, craft, medical field, or in any one of multiple occupational options provided by the state.

Preparation of nondegreed vocational education teachers. Occupational experience, rather than college credentialing, has been the primary entry point into teaching for T&I and health occupations teachers at the secondary level and for these and other technical teachers at the postsecondary level. This occupational experience requirement emanated from the Smith-Hughes Vocational Education Act of 1917 which specifically stated that instructors teaching in federally-funded vocational education programs must have had work experience in the specific occupational area in which they were hired to teach. According to Kaufman (1992), "Many states, therefore, have enacted policies and offered classes [author: and still do today] that enable skilled workers to be employed and credentialed as vocational education teachers without the educational requirements that most teachers must meet" (p. 6).

According to Pratzner and Ryan (1990), many nondegreed vocational teachers enter teaching directly from business and industry (including the military) with extensive occupational skills and experience, but with little or no pedagogical skills or preparation. This occurs especially at the postsecondary level and in the private sector, where state licensing and teacher certification requirements beyond occupational competence are usually not a consideration. However, as discussed previously (see section on Trade and Industrial Teacher Education), a large percentage of secondary trade teachers also enter classrooms for the first time without benefit of teacher preparation.

According to Duenk (1989), there is a trend away from complete dependency upon years of work experience or minimum clock hour requirements and toward use of some occupational competency assessment before allowing nondegreed persons to teach in vocational education classrooms. "Currently, there are 8 different types of evaluation in use among the 53 states and territories" (p. 18) that are used to assess the validity of the occupational experience. The most common type of occupational assessment is thorough licensure granted by the states in occupations such as cosmetology, various health technologies, plumbing, and auto mechanics. A second common method of occupational assessment is to require vocational teachers to pass occupational competency tests offered through the National Occupational Competency Testing Institute (NOCTI). Anywhere from 12 to 18 states require passage of a NOCTI exam either for initial certification, for recertification within the first year of teaching, or for preservice teachers lacking work experience (Duenk, 1989; Dykman, 1993).

How many vocational education teachers have not earned college degrees? The findings vary. According to recent data from Kaufman (1992), about 7.4 percent of the *total* vocational teaching force in grades 9–12 hold less than a bachelor's degree (compared with 0.3 percent of nonvocational teachers). [However, the data are not particularly meaningful since 27 percent of vocational teachers in the sample had an "unclassified subject area" or were classified as "other vocational, trade, and industrial education" (p. 35). About one-third in "unclassified" and one-fourth in "other" had less than a bachelor's degree. Additional categories included business education, home economics education, agriculture, career education, and industrial arts. The

findings that 7.4 percent of the *total* secondary vocational teaching force has less than a baccalaureate degree may be accurate (although at least one other study puts the percentage considerably higher), but the percentage is much greater for the T&I area. Further segmented data may not be reliable since the author assumed that many T&I teachers "threw in" with industrial arts and no one knows where teachers of marketing, health occupations, technical education, and other specialty areas "threw in."]

Pratzner (1987) reported 26 percent of beginning teachers were nondegreed vocational teachers who had completed some college but not a baccalaureate degree. Pratzner and Ryan (1990) highlight a study by Weber et al. which indicated that as many as 28 percent of vocational education teachers did not hold the baccalaureate degree at the time of the study. Obviously, these are considerably larger percentages than those found by Kaufman. Again, regardless of which study is cited, nondegreed teachers were almost exclusively teaching in T&I, health occupations, or other technical subject areas.

In their study focusing on public postsecondary vocational education, Hollenbeck et al. (1987) found that almost 21 percent of postsecondary instructors were nondegreed, 8 percent held a baccalaureate degree, and about 71 percent had graduate credit or a master's degree or higher. Similar to other authors, the vast majority of nondegreed postsecondary teachers were in T&I, technical, or health occupations subject areas.

Teachers in these three areas comprise a large percentage of the vocational teaching force. According to data provided in the *American Vocational Journal* (1991), 30.7 percent of high school vocational teachers are in T&I programs, another 1.6 percent are in health occupations, and 3.9 percent are in a technical field. At the post-secondary level, 17.5 percent of faculty are in T&I programs, 20.1 percent are in technical programs, and 19.4 percent are in health occupations programs.

There is considerable controversy among vocational and other educators about continuing to allow T&I (and other) vocational teachers to matriculate into classrooms without benefit of college-level preparation. Historically, the assumption that increased occupational experience will result in better teaching of a craft or trade was widely held among vocational educators, especially those in T&I. Various authors regularly reported that teachers' competence in T&I subject matter can only be obtained by experience on the job; that increased trade experience significantly increased classroom teaching performance ratings; that work experience was related to both teachers' and students' success in obtaining high scores on standardized trade tests; and, that because work experience was so valuable, college credit should be awarded for it as part of the major for bachelor's degree candidates (Duenk, 1990; Leighbody, 1972; Swartz, 1974; USDE, 1985).

However, some empirical studies question the assumptions that more trade experience earned by the teacher will result in better teaching and student performance. Welch and Gardner (1976) found that the amount of trade work experience did not result in increased student performance. More recently, Mullins (1993) found that years of trade experience had no significant effect upon the success of T&I teachers when evaluated by their immediate supervisor. Both studies failed to support the practice throughout the United States of requiring extensive work experience for state certification of T&I teachers.

Gray (1993) and others have commented that work experience and a workshop for new teachers are "woefully inadequate" for a T&I classroom that purports to prepare youngsters for the technical workforce of the future. Gray proposes a model of T&I teacher preparation that is based on a new mix of work experience, formal technical training, and formal pedagogical training. Lynch and Griggs (1991) call for a jointly planned and implemented field-based model of professional devel-

opment for nondegreed vocational teachers, resulting in a baccalaureate degree. A core pedagogical curriculum should be completed prior to any teacher assuming instructional roles in public schools.

There are more issues or problems related to nondegreed teachers in vocational education classrooms that are not in the literature, but are gleaned through interviews with practitioners; thus, generalizability about the whole issue of nondegreed teachers in the classroom is problematic. For example, it seems to be generally known that many nondegreed teachers face major problems in gaining admission to higher education because so many colleges and universities have standards that the teachers cannot meet, such as minimal standardized test scores, completion of college-prep curricula, or satisfactory completion of some alternative college-entrance requirements. If not admissible into a "regular" category, these vocational teachers are required by the institutions to enroll in developmental or remedial studies, which they often find demeaning. Even if admitted into regular or developmental programs, scheduling of these classes is difficult while concomitantly teaching full-time. Further, apparently a sizable percentage of probationary teachers do not pass NOCTI of other licensure exams.

Another problem frequently mentioned is that there is little economic incentive for nondegreed teachers to earn degrees. They usually earn as much money (and sometimes more) than their counterparts with degrees. Further, many are on extended day or year contracts which further inhibits their ability or incentive to earn a degree.

Thus, the hassles of required occupational and other testing, admission to higher education institutions, and access to college courses—combined with minimal economic incentive to earn a college degree—have contributed to the development of alternative state and local certification procedures that continue to result in less college and university involvement in providing general education, pedagogy, and subject-matter coursework to nondegreed vocational education teachers.

Some authors and speakers at conferences are questioning whether nondegreed teachers can teach applied math, science, communications, and other academically-related subjects in their vocational classes if they've had no collegiate preparation in the arts and sciences. Others calling for a bachelor's degree as a minimal requirement to enter teaching address issues related to professionalism and professionalizing the vocational teaching force. The controversy to require a bachelor's degree or not to enter continue teaching has not been resolved. However, there may be a slight trend for states to require a baccalaureate degree for all vocational teachers prior to their receiving a permanent, professional teaching certificate in that state. Apparently at least 17 states require the degree for permanent certification, but allow T&I teachers a considerable length of time to earn it (McDonnell & Zellman, 1992).

Preparation of degreed vocational education teachers: delivery systems/ curriculum. Other than trade and industrial education, technical education, and health occupations education, the primary delivery system for preparing vocational education teachers has been through a baccalaureate degree in a vocational education program area. Kaufman (1992) reports that 71 percent of vocational teachers major in an education area (e.g., agricultural education, business education, secondary education) compared to only 55 percent of nonvocational majors. Nonvocational teachers are much more likely to major in an academic subject field (mathematics, science, social science) than are vocational teachers. Further, fewer vocational teachers major in an occupationally specific area (e.g., business, computer science, engineering, health) than do nonvocational teachers major in an area of the arts and sciences.

The baccalaureate degree is the primary delivery system used by colleges and universities to prepare vocational education teachers. Only 6 of the 78 universities in Lynch's (1991) survey eliminated or planned to eliminate baccalaureate-level preparation for prospective vocational education teachers. Lynch reported that a second, much less frequently used model is through a post-baccalaureate program leading toward a graduate degree. In reality, both baccalaureate and post-baccalaureate vocational teacher preparation programs are offered on most campuses, sometimes in tandem. Further, there appears to be a slight trend to offer MAT (master of arts in teaching) programs for vocational educators with undergraduate degrees in nonteaching fields (Anderson, in press; Lynch, 1991). Other delivery models are available at some institutions on an individualized, case-by-case basis (e.g., major in a technical field to include teacher certification, education as a second major, education as a minor, double major with another secondary education field). Generally, the required curriculum anatomy of a vocational education undergraduate major is as follows: Total required semester credits = 128; approximately 37 percent or 47 credits in general studies, 43 credits (34 percent) in subject-matter courses typically offered in a college/department external to vocational education, 14 credits in vocational pedagogy, 14 credits in educational foundations, and 10 credits in student teaching. It is important to note that there are some (although not major) differences among vocational subject areas, especially as related to awarding credit for occupational experience and competency testing and credits earned in the technical content area. Trade and industrial education and health occupations are notable exceptions in these categorical areas.

The number of credits actually completed by those preparing to be vocational teachers is apparently considerably more than required. Through transcript analysis of 412 vocational education 1988–89 school year baccalaureate graduates from 22 southern universities, Finch, Schmidt, Oliver, Yu, and Wills (1992) found actual credit completion as follows: Total completed credits = 146.5; approximately 60 credits or 41 percent were in general studies, 50 credits (34 percent) in subject-matter, and 29 credits (20 percent) in education courses (10 credits in student teaching). Remaining credits were in physical education, health, or not elsewhere classified.

As was true in the Lynch study (1991), data provided by Finch et al. (1992) showed some differences among subject areas. Interesting to note was that 30 percent of the coursework completed in general studies was transferred from other institutions, presumably community or technical colleges. Nearly all general education credits earned (92 percent) were in lower-division (freshman-sophomore) courses. Further, these credits were skewed heavily toward the social sciences, humanities, and English. An average of only 8 credits were earned in mathematics and computer sciences and 10.5 in the natural sciences. And the number of math and computer sciences courses may be skewed by the relatively large number of business education majors in the data base—all of whom were required to complete computer courses. For example, technology and trade and industrial education majors averaged just 7.5 credits in mathematics and computer sciences. The authors commented that there may be potential general education course deficiencies in vocational teachers' undergraduate programs. "This is of particular concern if these graduates begin their careers by working with teachers of mathematics, science, and other general areas in the integration of vocational and academic education" (p. 16).

Pratzner and Ryan (1990) commented that there is little evidence of any increase in mathematics, science, or communications preparation for vocational education teachers. They further concluded: "It seems clear that, in general, beginning vocational education teachers did not pursue a rigorous liberal arts program... moreover, T&I teachers took significantly

fewer courses in these academic areas in their preservice preparation than any of the other beginning vocational teachers" (pp. 790–791).

Further analysis of university vocational teacher education curriculum design, particularly vocational education pedagogy, led Lynch (1991) to conclude, "it can generally be assumed that [graduates] received industry- or business-based occupational experience, preparation to work with at-risk or special-needs students, a course in computer applications, preparation on advising vocational youth organizations, preparation to work with business- or industry-based groups, and experience in a prestudent teaching clinical environment. It is less likely that they received instruction in...integrating basic skills with vocational education" (p. 194). Regarding the latter, other authors, too, reached similar conclusions that vocational teachers are not prepared to teach basic skills in vocational education programs (Anderson, 1991; Pratzner, 1987; Weber et al., 1988).

Supply and Demand of Vocational Education Teachers

Data and information discussed in previous sections about the current status of vocational teacher education in this country collectively lead to the conclusion that American colleges and universities have significantly diminished their commitment and capacity to produce teachers for America's vocational and technical education systems. This conclusion, then, leads to the obvious question: Will there be an adequate supply to meet the demand for vocational education teachers in the future? The answer to this question can not be answered with a simple "yes" or "no;" the appropriate response is "it depends."

Teacher demand and supply data are very difficult to validate and are fraught with great uncertainty, especially those related to supply. The demand for the total teaching force, including vocational education, may be easier to predict *if* we accept certain assumptions, for example: birth rates will remain relatively stable; the percentage of faculty who teach vocational subjects in high schools (currently about 20 percent) and postsecondary institutions (currently predicted at about 60 percent) will remain the same; students will continue to "demand" vocational and technical education at about the same percentage as they currently do; and turnover of teachers can be predicted, etc.—in sum. These factors will remain essentially as they are now or changes can be predicted, and thus we can extrapolate numbers to predict the demand for the future.

Various authors and agencies have used some or all of these factors, sometimes supplemented with survey data, and have predicted great demand for vocational teachers in the years ahead. Data in the *Vocational Education Journal* (1991) for example, cited U.S. Department of Labor data as predicting better than average demand for adult, secondary, and college vocational teachers and charted predicted demand as especially high for secondary and adult instructors. Further, Kaufman (1992) reported that about 27 percent of all high school vocational teachers were aged 50 or over (compared, incidentally, to 18.5 percent of nonvocational teachers, aged 50 or over). Presumably the vast majority of these over age 50 teachers will be retiring by the year 2000, and thus creating a high demand for their replacements.

The lead article in a recent *Vocational Education Journal* was entitled "Who Will Teach the Teachers?" In that article, Dykman (1993) concluded, "There is little data to support a claim of a [current] vocational teacher shortage" (p. 27). However, of 37 states that responded to her questionnaire, 17 indicated a demand for teachers in certain [but not all] vocational areas. Dykman points out that anecdotal evidence and some survey data show that many states are concerned about the future as teachers retire and high school student populations begin to swell again. Supply is difficult to predict. As discussed in previous sections of this paper, colleges and universities simply aren't producing a large quantity of vocational education teachers. Unless there are signifi-

cant changes made in our nation's colleges and universities relative to producing more vocational teachers, states will not be able to depend on them as a major supply source in the future. And the debate continues as to the wisdom of permitting people without college-level preparation and training in professional education to teach in vocational education programs.

But the problem of supply may be deeper than finding adequate numbers to staff classrooms. There is also the quality issue. Especially since 1984, the literature on teacher education in general has been fraught with commentary on the need to upgrade significantly the quality of the teaching force. As discussed by Lynch (1988) and placed in context for vocational education, the issue of quality seems to focus on two views of teacher education reform. One is grounded in the public perception of an "inadequately prepared, nurtured, evaluated, and compensated teaching (and related administrative and support) staff" (p. 115). The public and their state legislators simply have not felt our nation's schools were staffed with good teachers. Thus, over 1,000 pieces of legislation designed to reform teacher education were initiated by state legislative bodies in the mid-1980s (Darling-Hammond & Berry, 1988).

A second quality issue speaks of making teaching, once and for all, a respected profession. This means establishing requirements for training and entry into the field; defining the nature of the work, the structure of the job, and the authority that governs it; developing and monitoring accountability measures (i.e., through accreditation); enforcing a code of ethics, with special concern for clients; identifying a knowledge base that must be mastered by those who are to practice the profession; and preparing practitioners to exercise a high degree of autonomy—all based on interpretive and applicative knowledge. In essence, each view speaks to standards.

Finally—but closely related—what does the vocational and technical education teacher of the future need to know and be able to do? Do current teachers being produced possess the knowledge and skills needed in today's vocational and technical education classrooms? How about tomorrow's classrooms? Dykman (1993) noted that states showed need of teachers in high tech areas and then strongest in health occupations, skilled trades, and technology. However, these are not areas for which colleges and universities seem to produce teachers.

Perkins II legislation, anticipated school-to-work transition legislation, and national and state reports addressing reform in vocational education imply that teachers must be prepared, for example, to (a) implement programs of tech prep, (b) integrate academic and vocational education, (c) operate apprenticeship and other school-work connected programs, (d) serve at-risk learners effectively, (e) use computers and technology throughout the instructional program, (f) design new and innovative curriculum and instruction for the contemporary workplace, (g) provide for leadership development among students, (h) inform students of multiple career options and career paths, etc. Are current vocational teacher education programs preparing their graduates to implement these programs and practices?

The next section will examine the responsiveness of vocational teacher education to four initiatives prominent in Perkins II legislation: (1) tech prep; (2) integration of vocational education content and programs; (3) school-to-work transition and interacting with business and industry; and (4) work with special populations.

Responsiveness of Vocational Teacher Education to Major Initiatives in Perkins II

A second major purpose of this paper is to provide data and information about the responsiveness of vocational teacher education to major initiatives in Perkins II: (a) tech prep, (b) integration

of academic and vocational education content and programs, (c) school to work transition, and (d) work with special populations. The data and information are limited as follows:

Survey data collected and reported herein were limited to the 20 universities currently (1993) affiliated with the University Council on Vocational Education (UCVE). Funds were not provided to survey beyond these universities. The data are self reporting, in response to open-ended questions, and limited to the amount of information and detail provided in writing by the respondents. No attempt was made to validate the information beyond the evidence provided through the mail by the respondents (e.g., some attached course syllabi, catalog descriptions of new courses, workshop announcements, abstracts of research projects, etc.; others did not submit attachments).

There is little in the extant literature that describes efforts at colleges and universities to respond to Perkins II initiatives. Since Perkins II has so recently been implemented nationwide, it is probably too soon for articles to be published about college and university efforts in this legislated arena. A few articles and studies that did report on implementation efforts are included with the data presented in the following sections. Some of the efforts identified were begun prior to implementing Perkins II.

Data and information focus on vocational teacher education as it exists in our nation's colleges and universities, primarily at the preservice level. There has been much state- and local school-sponsored activity (e.g., conferences, technical assistance, workshops) to help in-service vocational educators on implementation of tech prep, integration of academic and vocational education, implementation of school-to-work transition programs, and better service to special populations. Many university vocational teacher educators have been involved with these activities—usually on a state-funded contractual basis or as an independent consultant. However, this section only discusses that which is known about responsiveness to Perkins II initiatives at the colleges and universities themselves.

Methodology

Member institutions of the University Council for Vocational Education were asked to provide information concerning vocational teacher education responsiveness to the Carl D. Perkins Vocational and Applied Technology Education Act Amendments of 1990. Appendix A contains further information about UCVE-affiliated universities. All of these institutions have vocational education units with a primary mission that includes teacher education, production and dissemination of research, provision of service, and awarding of doctoral degrees. The request for information was discussed with the UCVE Board of Trustees and institutional members at their July and December, 1993 meetings. The Board of Trustees advised the data collection effort and helped assure response from faculty and staff at the various members' institutions.

Survey questionnaires were mailed to the vocational education unit chair at each of the 20 UCVE-affiliated member institutions. This person was requested to summarize activity in four content categories: (1) tech prep; (2) integration of academic and vocational education; (3) school-to-work transition and collaborative programs with business, industry, and labor; and (4) work with special populations. Abstracts of courses, syllabi, research abstracts, descriptions of workshops, etc. were requested. A fifth category on the questionnaire allowed respondents to provide their thoughts concerning a lack of activity nationally in any of these areas.

The overall response rate to the questionnaire was 95 percent, with 19 of 20 universities responding. One university is currently undergoing major restructuring of its vocational and technical teacher education programs and was not prepared to respond adequately to the survey.

Responses to the survey questionnaire were open-ended; thus, they were qualitatively assessed and coded according to theme or pattern of answers.

Thematic Divisions

Thematic divisions for the four general categories include Teaching/Instruction, Research, Evaluation, and Technical Assistance. Further descriptions of each of these themes is as follows:

(1) *Teaching/Instruction* includes class and related activities such as discussions, guest speakers, readings, teleconferences, and assignment of student oral and written reports.

(2) *Research* includes theory building and data collecting that results in the publication of monographs, articles, book chapters, and theses or dissertations.

(3) *Evaluation* includes program evaluation at either the local, state, or national level.

(4) *Technical Assistance* includes activities to improve teachers' instructional quality by sponsoring or conducting workshops, seminars, meetings, conferences, institutes, and other preservice or inservice activities; also includes assistance with helping schools and postsecondary institutions in areas such as program organization, developing measures and standards, and curriculum development.

Although the survey asked for discrete information in the four separate categories of tech prep, integration, school-to-work transition, and special populations, responses indicate that these issues often overlap in practice.

For example, tech prep and integration appear to be highly linked, as are tech prep and school-to-work transition. For analysis purposes, activities were categorized as they were presented by the respondents. Thus, the activities were sometimes reported as separate subunits of an overarching university project or series of projects that incorporated two or more of the four categories. For example, sponsoring an institute for applied academics was sometimes reported under both tech prep and integration. Southern Illinois University at Carbondale reported that "most activities combine the tech prep notion with integrating academic and vocational education."

Another example of the interconnectedness is from the University of Georgia. There, faculty in a newly conceptualized Department of Occupational Studies (created from 6 former departments in 2 administrative divisions) have integrated into various courses a futuristic workforce development focus consisting of eight major themes: tech prep, integration, school-to-work transition, technology, special populations, workplace change, research-to-practice, and leadership.

Findings

Results indicate a high level of activity among universities in at least one of the four content categories. In general, it can be concluded that vocational teacher education students are at least being made aware of—through class presentations and discussions, guest speakers, readings, video teleconferences—the major initiatives in the Perkins legislation. Most of this is infused in pre-existing (i.e., prior to Perkins II) vocational education methods, curriculum, or foundations classes.

Further, one or more teacher educators at most institutions are involved in providing technical assistance to public schools and postsecondary institutions in one or more of the major initiatives, usually on a funded contractual basis with a state agency or a local consortium.

It is far less certain that a solid theory and research base to undergird the initiatives—through research and evaluation projects—is being provided by many of the universities.

Tech prep. Eighteen of 19 respondents (95 percent) reported activity in tech prep. Most of the activity is in the teaching/instruction category (n=16; 84 percent) and in the provision of technical assistance (n=15; 79 percent).

Most universities present information about tech prep in various classes. Examples include use of video and printed materials, guest speakers, field trips, teleconferences, and curriculum materials developed for applied academics courses. Two universities (Texas A&M and the University of Illinois) are teaching a graduate course specific to tech prep. The University of Arkansas is offering a graduate course, "Tech Prep/Applied Academics." Auburn University, the University of Minnesota, and the University of Idaho offer special seminars or topics for credit on tech prep.

Further, individual faculty or faculty teams from 15 UCVE-affiliated universities are actively involved in providing technical assistance to schools on implementing tech prep, usually under grant or contract funds from the state department of education or a local school consortia. For example, two faculty at Colorado State University assist that state's schools in forming tech prep consortia and then advise on curriculum and process matters. Several universities (e.g., Auburn University, University of Kentucky, Southern Illinois University, North Carolina State University, University of Illinois, University of Minnesota, and the University of Missouri) have sponsored workshops, institutes, or conferences on tech prep.

One faculty member at Texas A&M is especially involved with that state's tech prep initiatives. He has conducted eight all-day workshops for K–12 counselors in a consortium, served as conference coordinator for a four-day statewide workshop for junior high through university counselors, team taught a graduate course on tech prep, and helped to organize the state's 25 tech prep consortia. He envisions continued focus on professional development through teleconferencing and other forms of distance learning. He also hopes to use a town hall meeting format to further introduce students and parents to tech prep concepts.

One faculty member at Louisiana State University is working with other educators to form a teacher-educator consortium, with support from the state department of education, to assist secondary and postsecondary consortia with tech prep and integration activities and to help them develop a strategic plan to implement higher-level academics. Further, the teacher education programs at LSU are developing new courses for postsecondary teachers and helping to change teacher certification to reflect new and expanded roles for vocational education teachers.

There is limited activity in tech prep research or evaluation. Only three universities report tech prep-related research activities, and three report involvement with tech prep evaluation. In addition, two doctoral students at Ohio State University and one at the University of Georgia are working on tech prep related dissertations.

The major research and evaluation activities appear to be identified with universities affiliated with the National Center for Research in Vocational Education (NCRVE). For example, researchers at the University of Illinois have conducted several national and state-level studies that have included concept mapping with stakeholders in tech prep, a needs analysis for tech prep teacher preparation, and an evaluation design. They have also prepared an implementation guide and an annotated resource list, organized a national forum, and evaluated tech prep activities in two states. One faculty member at Virginia Tech has several NCRVE publications reporting on tech prep, including implications for graduate and undergraduate studies. Both Virginia Tech and the University of Minnesota—as well as Auburn University—have contracts to evaluate tech prep projects in their respective states.

One interesting twist on the tech prep concept is being initiated at The Pennsylvania State University. Faculty are working with several postsecondary institutions in central Pennsylvania to organize a 2+2+2 program to encourage vocational high school students to become teachers. Students complete two years of vocational-technical training at their high school or area vocational-technical school. Then, these students go on to a two-year degree program, acquiring an associate's degree while working in their trade area. The last phase is two years at Penn State's campus to complete a baccalaureate degree and teaching requirements.

Finally, three universities have reported *some* restructuring in their preservice programs to reflect tech prep. Auburn University has revised its industrial arts program to reflect a tech prep model. The University of Georgia has restructured its trade and industrial education, industrial arts, and health occupations programs into a new major and program in technological studies. Louisiana State University is in the process of revamping programs to better meet the professional needs of postsecondary technical educators.

Integrating academic and vocational education. All 19 respondents (100 percent) reported activity at their universities related to the integration of academic and vocational education; 15 (79 percent) reported activity in teaching/instruction, 6 (32 percent) in research, 0 in evaluation, and 18 (95 percent) in technical assistance.

Similar to that reported in tech prep, most activity in teaching/instruction takes place in pre-existing classes and is heavily at the awareness—or information giving—level (e.g., speakers, short units, tapes of teleconferences, readings). This activity occurs at the preservice level at 12 (63 percent) universities. Of the 12, four universities (Auburn, Georgia, Illinois, Oklahoma State) have modified some courses substantially or added *some* courses in vocational education programs to include integration.

Beyond this, no university reported any significant, broad-base changes in general education requirements, curriculum and instruction courses, or other university classes to develop skills of integration among preservice or master's level students. All changes were reported within, not beyond, the vocational education unit(s). Combined with data collected by Lynch (1991) and the conclusions reached by Finch et al. (1992), it continues to appear as though vocational teacher education students are not being adequately prepared to implement vocational and academic education. And there is no evidence that other teaching majors (e.g., math, science, English education) are receiving any preparation on integration.

There were some isolated, vocational education subject-specific areas where substantive integration activities were reported—such as teaching a principles of technology course (applied physics) to technology education majors or teaching scientific principles and applied mathematics to technology or agricultural education majors. Also, the Vocational Education Department at the University of Minnesota reported plans to initiate a new doctoral study program with the Department of Educational Policy and Administration to prepare educators for leadership roles in two-year institutions of higher education. At the University of Minnesota, the integration of academic and vocational education is being modeled in program design and content. However, beyond these few isolated examples, the practices of successful integration as being implemented in high schools and community colleges—new curricula approaches, academic and vocational team teaching, use of applied academic modules, new courses, and reorganizing departments according to occupational clusters and career paths (see, for example, Beck, 1991; Grubb, Davis, Lum, Plihal, & Morgaine, 1991; Grubb, 1991; Clapsaddle and Thomas, 1991)—are not happening at any university.

Nearly all UCVE-affiliated universities report providing faculty technical assistance beyond the college campus. Fifteen of the 19 universities reported activities such as participating in or sponsoring workshops or conferences; providing consultative and technical assistance to state agencies or local schools; developing applied academic curriculum for use by vocational education teachers; conducting short sessions on topics as specific as teaching with the aid of various commercially-packaged courses (e.g., Applied Communications, Applied Biology/ Chemistry, Applied Mathematics, Principles of Technology); and offering independent study and/or evening school courses.

Colorado State University reported involvement with various integration activities, such as large group awareness sessions, teacher teams, and implementing academic models. Colorado State University is also responding to requests to provide training for teachers and counselors on the products of its federal grant, "Integrating Basic Skills in Vocational Teacher Education and Counselor Role and Educational Change." Penn State has implemented a S.W.A.T. (Strategic Wakening for Activating Transitions) team to enhance program delivery systems, program planning, and integration issues. The University of Missouri-Columbia has developed a management and tracking system to facilitate identification of academic outcomes required for performance of vocational competencies.

Six universities reported research activity, including (1) dissertations by doctoral students at Ohio State University and the University of Georgia; (2) identification by a Oklahoma State University faculty member of effective teaching strategies using an integrated curriculum; (3) development of concepts and data related to situational learning, cognitive apprenticeships, and teacher education as further foundation to integrate vocational education, technology, math, and science (one project funded, two in review for funding) by faculty at the University of Georgia; (4) a case study on raising academic achievements of high school vocational education students and the effects of site-based decision-making by the University of Kentucky; (5) identification and development of basic and advanced academic skills for marketing education programs by a faculty member at the University of Missouri; and (6) several studies funded by the NCRVE at Virginia Polytechnic Institute and State University and the University of Illinois. Three of Virginia Tech's published funded projects focused on the teacher's role in integration.

It is interesting to note that *no* university reported any evaluation activity at either the local, state, or national level.

School-to-work transition and collaborative programs with business and industry. Seventeen respondents (89 percent) reported activity in school-to-work transition and collaborative programs with business and industry. The following is a summary of responses according to thematic division: Teaching/instruction (n=13; 68 percent), research (n=4; 22 percent), evaluation (n=2; 11 percent), and technical assistance (n=7; 39 percent).

In the teaching/instruction category, 13 universities reported activity. Five are offering newly-developed courses focusing on apprenticeship programs, education-labor force linkages, or work-based education programs: University of Arkansas, University of Georgia, University of Idaho, University of Minnesota, and Southern Illinois University (for its training and development majors).

In addition, these and 6 other universities indicate that school-to-work transition topics are infused in such classes as coordination of cooperative education, organization of occupational education, training in the workplace, and special graduate seminars. In addition to discussions, readings, and lectures, respondents mentioned that methods in these classes often include job site visits, training needs assessment of local industries, industry tours, community surveys, develop-

ment of model training programs and plans, field interviews, and business-industry short-term faculty exchanges.

A few universities mentioned specifically that they require students to obtain a certain amount of work experience to be recommended for a teaching certificate. For example, the University of Nebraska, the University of Idaho, and Virginia Tech require university-supervised business internships/work experience for some of their vocational education majors.

It was interesting to note that programs or courses on transition are targeted specifically to students with special needs at two universities: Colorado State University and the University of Georgia.

Major research activities on school-to-work transition seemed to be primarily at the NCRVE-affiliated institutions: Virginia Tech and the University of Minnesota in collaboration with the University of California at Berkeley (UC-Berkeley is *not* affiliated with the UCVE). In addition, a doctoral student at Ohio State University is focusing on transition/collaboration issues for dissertation research. A faculty member at the University of Georgia has written a book chapter on collaboration between agribusiness and agricultural education, two others have prepared separate research-based reports for information by state policy groups, and two others have published extensively on transition of disabled, economically disadvantaged, and at-risk students.

Only two universities report evaluation activity. Faculty at Penn State are evaluating the effectiveness of the state's youth apprenticeship pilot programs, and a doctoral student at the University of Arkansas is conducting an evaluation of that state's apprenticeship programs.

Seven universities reported providing technical assistance activities. The University of Illinois operates a federally-funded leadership development program focused on transition for special populations. Faculty at the University of Minnesota provide considerable technical assistance to states and local schools on implementing and operating school-based work programs. North Carolina State University developed a school-to-work manual for use in local schools.

Three respondents mentioned assistance with state agencies or commissions investigating workforce development and training issues. Two mentioned customized training activities with business and industry, and four reported new foci in providing human resource development programs for industry-based educators.

Work with special populations. It is interesting to note, on the onset, that of the four general areas for which information was requested from UCVE-affiliated universities, this category—work with special populations—generated the least response and commentary. This seemed surprising and a bit disconcerting given the significant emphasis in Perkins I and Perkins II legislation to better serve special populations. However, findings do seem to support the concern of Rojewski and Greenan (1992) that many states—through certification policies—are not mandating better preparation of vocational teachers to serve special populations.

For information purposes, special populations were described as individuals who are learning disabled, physically handicapped, speech impaired, emotionally disturbed, mentally retarded, deaf, or blind/visually impaired (Peterson and Thomas, 1987); minorities (Jeria and Roth, 1992); older adults (Sorensen, 1990); and immigrants, limited-English proficient, and economically disadvantaged (Rojewski and Greenan).

Sixteen respondents (84 percent) did report some activity in the category, Work With Special Populations; 10 (53 percent) in teaching/instruction, 3 (16 percent) in research, 1 in evaluation, and 13 (68 percent)in technical assistance.

Of the 10 universities reporting information on instruction, 5 universities infuse instruction about special populations throughout preservice classes and 5 (the Universities of Georgia, Arkansas, Idaho, Nebraska, and Virginia Tech) require a special course. Five universities (Colorado State, Georgia, Minnesota, Nebraska, and Virginia Tech) have graduate-level foci in vocational special needs. The University of Arkansas also offers career exploration and supervised work experience in cooperation with the Department of Rehabilitation and Research.

Major national research and dissemination activities are centered at the University of Illinois where the NCRVE's major research and technical assistance program is administered. In addition, several other universities reported faculty who publish in the area of vocational special needs.

Faculty at 13 UCVE-affiliated universities are involved with providing technical assistance to vocational educators in their work with special populations, mostly as funded through state grants and contracts. For example, a faculty member at Texas A&M has annually sponsored a statewide conference, prepares a newsletter, operates a reference library, and analyzes assessment instruments for purposes of serving special populations. Faculty at Colorado State University are providing assistance with state grants variously titled, "Partners in Parent Education," "Survival Skills for Homeless, Runaway, and Throwaway Youth," "Transition Center for High Risk Youth," and "Personnel Preparation" to train related service personnel to work with high risk youth transitioning from school to work. The University of Kentucky funds a teacher educator to work throughout the state with vocational teachers to help them with vocational special needs students.

Only one university reported any work on evaluation. Auburn University is evaluating the effectiveness of programs designed to meet the needs of prison populations.

Thoughts regarding lack of activity. Respondents were invited to respond to the question: "Any thoughts as to why there seems to have been little activity from vocational teacher education nationally in any of the above?" Needless to say, responses varied—from terse one or two words, to three or four reasons, to rather lengthy discourses—in response to the question. Five respondents chose not to answer or did so by stating, in effect, "We are responding to Perkins II." All of the responses from 14 UCVE-affiliated universities were eventually able to be categorized into 6 major themes: (1) funding, (2) time/priorities, (3) philosophy or lack of a theory base, (4) unwillingness to change, (5) lack of involvement from teacher educators, and (6) need for professional development.

By far, the most frequently mentioned reason for seemingly little action from teacher education is the lack of funds. Eleven respondents specifically mentioned their unit's financial situation with phrases such as:

> "No funding for anything new; we were lucky to survive with what we've had."
>
> "The lack of activity... is a reflection of the way legislation is written.... Universities are not given funds to initiate activities."
>
> "Perhaps since the legislation, i.e., funding, the teacher educators feel less affected by the legislation."
>
> "Lack of flow-through funds from state department of education to university-based programs to assist in supporting efforts relating to above topics."

Time/priorities was a second major theme and was mentioned by respondents from 9 institutions. Respondents made statements that initiatives in Perkins II were not consistent with their research foci or that they simply couldn't implement activities due to insufficient time. This theme also is seemingly related at some institutions to the cut in numbers of faculty. A few responses:

> "Time to learn about and treat these new topics is a common complaint."
>
> "Burnout?? Decreasing number of teacher educators? I seem to be running as fast as I can doing what the university demands and what I need to do to recruit students. These things are highest priority."
>
> "[There is a] lack of sufficient faculty to plan, develop, and carryout programs and activities related to these areas."
>
> "University people are too busy with day-to-day activities that have a higher priority, i.e., publishing, teaching, and dealing with sweeping changes in teacher education."

A third theme that emerged from qualitative feedback is philosophy or lack of a theory base felt necessary to support the Perkins II changes either by vocational teacher educators or by their colleagues at the university. Or, at least the faculty were not sufficiently convinced there is an adequate theory base to bring about the appropriate changes in Perkins II. In other words, a number of vocational teacher educators in at least 8 universities weren't "buying" the changes themselves to sufficiently implement them or their colleagues (e.g., deans and co-workers in other academic units) were not sufficiently "sold."

> "Support for above efforts in universities must comelargely through reallocation of existing resources at a time when overall level of resources is being reduced."
>
> "There is little or no research available and . . . [besides] teacher educators want things to be the way they were."
>
> [We have] "difficulty in getting interest or commitment from other departments."
>
> "Lack of theory base to reason about the issues."

Closely related is unwillingness to change. Similar to not being convinced of the philosophy underlying Perkins changes or claiming lack of an adequate theory base, faculty at 8 universities are simply not interested in changing. A related and strong sub-theme was faculty members' rigid adherence to traditional turf.

> "Vocational teacher educators, in general, come from content specific programs: agriculture, marketing, business, home economics, health occupations, etc. and... unfortunately...time and loads over the past few years have not provided much of an opportunity to broaden our focus."

"Basically, change is often difficult for individuals and is even more difficult for systems."

"Organization of university programs along specialized vocational fields sometimes makes it difficult to work at cross-cutting topics as those represented in above headings."

"Faculty members are afraid (or do not want) to work with others in designing collaborative programs. Departmental barriers."

A fifth theme surfaced dealing with teacher education being kept "out of the loop" and not involved with changes in Perkins II.

"Our state has chose to develop [Perkins II initiatives] without informing and/or involving teacher education."

"Perhaps another reason that teacher educators are not involved is because this is perceived as a state department of education domain in which they really don't want our input at this time."
"Lack of communication between agencies, staff—who's doing what."

A final theme focused on the need for professional staff development for teacher educators themselves.

"It may be due to the fact there have *not* been in-service programs organized or funded to train or retrain teacher education in these types of activities."

"Faculty members lack knowledge and experience."

"Very little in-service education/instruction on these topics for teacher educators. We are expected to read and apply with almost no training. Our cups are full, help us to see how this will benefit our existing efforts."

Issues for Consideration

This final section highlights a few key issues from the author's presentation and interpretation of data and information related to vocational teacher education. It is hoped that NAVE II might speak to these issues and provide remediation in subsequent legislation.

(1) Colleges and universities have diminished greatly their capacity to produce teachers for our nation's systems of vocational and technical education. There are many reasons for this, chief among which is the loss of federal and state funds. Structures must be rebuilt (or perhaps "born again") if an adequate supply of teachers is to be provided for our nation's public schools, vocational and technical institutes, and community colleges.

(2) But it isn't only a problem of numbers. There is little consensus on the theoretical framework for subject matter and the related pedagogy for preparing 21st Century teachers to teach in

vocational and technical education. Therefore, research and consensus building on the knowledge base to undergird teacher preparation is imperative.

What is it teachers need to know and be able to do to teach *all* work-bound students as they prepare for employment in the 21st Century workplace? The knowledge base will undergird development of a core curriculum and core pedagogy for *all* teachers in vocational and technical education programs.

(3) Minimal standards must be developed for secondary and postsecondary faculty in federally-funded vocational and technical education programs. The wide-spread practice of credentialing vocational education teachers primarily on the basis of an arbitrarily-determined number of years or hours of work experience ought to end. Standards (or demonstrable outcomes) should be comparable to those drafted by other education professions and policy groups (e.g., National Council of Teachers of Mathematics, Council of Chief State School Officers, National Board for Professional Teaching Standards, National Association for Accreditation of Teacher Education).

(4) Financial assistance ought to be provided to some colleges and universities who will:

- commit to prepare preservice and inservice teachers to deliver on the major initiatives in Perkins II and other components from an agreed-upon knowledge base;
- commit to a professional identity with vocational and technical teacher education, broadly conceptualized and appropriate to the nation's futuristically-oriented vocational and technical education systems;
- experiment with new conceptions and new models of delivering teacher education;
- provide a solid general education to prospective vocational education teachers, including perhaps 12 semester credits in mathematics/technology, 12 credits in science, 12 credits in language arts, and 12 credits in social sciences (some credits should be earned in applied subjects);
- integrate pedagogy with subject matter and academics and include collaborative activities with teacher educators and students from other professional education subject areas (math ed, science ed, adult ed, and language ed);
- provide faculty teams and related resources and then prepare them to offer quality vocational teacher education;
- recruit nontraditional students into teacher education;
- offer a field-based model for nondegreed but practicing vocational and technical education teachers to enable them to earn a baccalaureate degree within a reasonable period of time;
- include instruction appropriate to diversity, special populations, technology, adult education, the cognitive sciences, and contextual learning;
- agree to conduct research and evaluation studies on their own programs and those offered in secondary and postsecondary schools in their geographical areas;
- integrate theory and research with practice;
- coordinate or administer vocational teacher education through a college or school of education; and
- provide staff development of vocational teacher educators to include technical, technological, and pedagogical updating.

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Appendix A

University Council for Vocational Education

The University Council for Vocational Education is an organization composed of 20 major universities which provide research, service, teacher education, and advanced graduate studies in vocational and technical education. As of September 1, 1993, the following universities are UCVE members:

Auburn University
Colorado State University
North Carolina State University
Ohio State University
Oklahoma State University
Oregon State University
Louisiana State University
Pennsylvania State University
Southern Illinois University at Carbondale
Texas A&M University
University of Arkansas
University of Georgia
University of Idaho
University of Illinois at Urbana-Champaign
University of Kentucky
University of Missouri-Columbia
University of Nebraska-Lincoln
University of Tennessee
University of Wyoming
Virginia Polytechnic Institute and State University

Occupational Experience as the Basis for Alternative Teacher Certification in Vocational Education

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Abstract

The primary purpose of this paper was to provide data and information about the occupational experience of alternatively certified vocational and technical education teachers and its relationship to teacher and student performance. The extant research literature provided the source for the paper.

The following are among the conclusions reached from the collective evidence in the literature. (1) Nearly all vocational and technical education teachers have acquired paid occupational experiences as a prerequisite to employment in vocational education, although some systems permit applied experiences in college classrooms and laboratories to substitute. (2) In some subject areas (primarily T&I and Health Occupations programs), years of occupational experience and/or satisfactory scores on occupational competency tests replace college degrees and courses in teacher preparation. (3) There is no reliable correlation between years of occupational experience or scores on occupational competency tests and such variables as teacher qualifications, satisfaction, or effectiveness. (4) Some occupational experience is helpful, especially for novice teachers. (5) Better educated teachers produce better educated workers for our nation's workplaces. As a corollary, better educated vocational education teachers and effective programs enrich the post-graduation earnings and workplace performance of graduates. (6) Beginning teacher induction programs in general are quite dismal and not responsive to the unique needs of alternatively certified vocational education teachers.

Background

The paper supplements the one prepared in September of 1993, entitled "Vocational Teacher Education in U. S. Colleges and Universities and Its Responsiveness to the Carl D. Perkins Vocational and Applied Technology Education of Act of 1990." Both papers were commissioned in response to Public Law 101-392 (1990), Section 403, National Assessment of Vocational Education Programs. In this section of the Law, Congress requested that the national assessment of vocational education include "descriptions and evaluations" of the "preparation and qualifications of teachers of vocational education programs, as well as shortages of such teachers" (p. 809). This paper attempts to add information and data to that already submitted about the preparation and qualifications of vocational education teachers.

The information and data provided in this paper are focused primarily on the occupational experiences of vocational education teachers. A special effort has been made to review studies of and about trade and industrial, technical, and health occupations teachers who are "alternatively certified." For these teachers, traditional state teacher certification requirements, such as college degrees and preparation in liberal arts and pedagogy, are waived in lieu of considerable occupational experience.

Answers were sought to questions, such as: "What occupational experiences do vocational education teachers bring to their jobs?" "Does trade or occupational experience result in more effective teaching or greater student achievement?" "Is there a correlation between occupational experience, occupational competency, and teaching effectiveness in vocational education programs?" "Can years of occupational experience supplant college-level education and pedagogical training?"

The extant literature is the primary basis for the information, data, and conclusions presented in this paper. Sources used to identify studies included (a) an ERIC search of the literature; (b) scanning of journals typically read by vocational educators; (c) solicitation of studies through UNIVOC and ADVOCNET, the two national e-mail discussion groups targeted to the vocational education profession; (d) personal interviews with some authors known to have conducted research on the topic; and (e) solicitation of assistance in identifying relevant studies at the annual meetings of the National Association of Trade, Technical, and Industrial Teacher Educators and the University Council of Vocational Education.

Introduction

It is generally a cornerstone in both the early and contemporary literature that beginning vocational education teachers must be expert in two arts: the art of teaching and the art of a craft or trade. If only one of these is available, preference seems to be given to employing vocational teachers who are deemed competent in some trade or craft. In other words, the prevailing philosophy has been that you can teach an experienced tradesperson to teach much easier than you can teach a prospective (or practicing) teacher a craft, a trade, or a business.

Throughout the history of vocational education in this country, the value of occupational experience for the vocational education teacher has been proclaimed. Opinion and rhetoric abound in the literature of the need for occupational experience as a requirement for teaching in vocational education programs.

As cited in D. L. Beidel (1993), the 1914 writings of Taylor emphasized that vocational-industrial teachers must know the technique of the trade to command the respect of employers and foremen. The

National Society for the Promotion of Industrial Education (NSPIE, 1914)—the forerunners of the 1917 Smith-Hughes Act, the original federal vocational education act—concluded that:

> Trade teachers should first of all be masters of their trade. To be qualified to teach their trade they must have lived it; from this trade experience they bring skill and intimate acquaintance with the best practices of its every branch (p. 12).

NSPIE did point out that trade experience was not enough and encouraged teachers to acquire pedagogical skills as well.

Thus, the Smith-Hughes Vocational Education Act of 1917 specifically stated that instructors who were to teach in federally-funded vocational education programs must have had work experience in the specific occupational area. The states enacted policies and processes to recruit and credential skilled workers to be employed as vocational education teachers without requiring them to have any postsecondary training in the liberal arts or in education.

The Federal Board for Vocational Education was established by Congress to administer the Smith-Hughes Act and to oversee the operation of vocational education in this country. The Federal Board perceived that land-grant colleges and state universities were not capable of preparing trade teachers. It is interesting to note, however, that the Federal Board apparently felt institutions of higher education were capable of preparing agriculture and home economics teachers—provided the "boys" had "lived and worked on their parents' farms and...graduated from the vocational agricultural departments of county high schools" (Prosser & Quiqley, 1949, p. 310). As for the "girls":

> And a similar encouraging tale is being told of the college trained homemaking teacher, who domestically inclined, had her homemaking interests, insights, and practical doing and managing abilities further developed by the successful accomplishing of her homemaking projects under the cooperative tutorage of her mother and her high school homemaking teacher (p. 310).

But, in general, the Federal Board and Charles Prosser—its first administrative director—felt college and university teacher training "can contribute little or nothing to the training of teachers in vocational subjects of secondary grade" (Prosser and Quiqley, 1949, p. 307). One of Prosser's 16 theorems includes:

> [V]ocational education will be effective in proportion as the instructor has had successful experiences in the application of skills and knowledge to the operations and processes he undertakes to teach (p. 223).

Thus, the Federal Board proposed, and states accepted, shorter curriculum, extending over a few months, either during the evening or day, as the most beneficial way in which to prepare tradesmen and craftsmen to enter the teaching profession. College-level training was not expected nor necessarily desirable.

Subsequent writings of various philosophers and authors who molded and shaped the development of vocational education also touted the value of occupational experience for vocational education teachers. Roberts (1957 and in subsequent editions) identified as a major principle of vocational education, "Vocational education personnel should be occupationally competent" (p. 586). Miller (1985) also stated as an essential principle: "Teachers of vocational education are

both professionally and occupationally competent" (p. 81). Mason, Furtado, and Husted (1989) stated that "Prospective vocational education coordinators need the equivalent of at least two years (4,000 hours) of business or industrial experience" (p. 124).

This practice is still prevalent today in preparing teachers for trade and industrial education, technical, and health occupations programs in our nation's public secondary and postsecondary schools. Demonstration and verification of occupational competence and experience is considered to be proof of the teacher's mastery of the subject matter to be taught.

The philosophy or beliefs, too, have been (and remain quite firmly entrenched today) that certification of trade and industrial education teachers is somehow *unique* and should be differentiated from those who teach in academic or general areas and even those who teach in other areas of vocational education (for example, in business education, home economics, or marketing education). As early as 1914, the NSPIE stated that individual states should be the sole certifying authority and decide who should teach. Trade teachers should be employed based on examinations, personal interviews, and practical demonstrations of their trade. "This certification process should be separate and apart from the certification of regular teachers" (Beidel, 1993, p. 3).

Similarly, the Federal Board for Vocational Education, in 1917, perceived that state certification requirements were too high and were sacrificing technical proficiency for professional training. According to the Federal Board as cited by Beidel (1993), "Public criticism of vocational teaching was most often directed at practical deficiencies.... The common complaint of typical teacher training came from practical artisans who said school work was not practical and was too far removed for industrial conditions" (p. 5). The conclusion then, and in effect today, is that alternative schemes of certification for vocational education teachers were needed and that important modifications must be made in state certification from those used to certify academic teachers. College-level preparation was not warranted and indeed not necessarily desirable. As discussed by Leighbody (1972):

> It is chiefly in the trade and industrial subjects that teachers are recruited directly from the occupation itself, with no college training or degree and with no prior plans or preparation for teaching. [This] field tends to dominate the thinking of the overall program of occupational education and has been the most impervious to change. Trade and industrial educators have long insisted that the necessary subject competence can only be attained by lengthy experience on the job and that to secure such teachers it is necessary to forego formal education in favor of occupational experience, and convert craftsmen into teachers (p. 138).

Beidel (1993) describes four types of instructor training courses ("alternative certification") implemented early in the history of vocational education and still in effect today:

1. Short-unit, continuous, intensive workshops—often conducted in the summer or when schools are typically not in session, usually about four weeks in length;
2. Short-unit, discontinuous training, dispersed throughout the school year on weekends or on teacher workdays;
3. One-on-one, on-site teacher training provided by an itinerant teacher educator (sometimes in tandem with #1 and #2); and
4. Long-term continuous training and education, resulting in a college degree(s) while teaching, concomitantly, in a public school.

Various surveys place the clock hours of professional training for alternatively certified vocational education teachers, including those without baccalaureate degrees, at a range from 0-576, with an average of about 120 clock hours.

In general the first three types of instructor training have been referred to as "survival skill training." Duenk (1990) reports that 24 states require such survival training. According to Beidel (1993):

> The aim of instructor training was to provide professional knowledge and experience to those who already were masters of an occupation, trade, or subject which they were to teach. General education was also included in this training, but carefully monitored to use only material to be directly reflecting and of actual value to new or prospective teachers. These individuals were accustomed to thinking in concrete rather than abstract terms and the training should pertain to their most immediate needs (p. 6).

These survival courses usually focus on very basic, specific competencies such as occupational analysis, use of instructional sheets, preparation of teaching aids, use of audio visual equipment, preparation of lesson plans, selection of instructional materials, safety practices, and grading.

Thus, throughout the 75 year history of public vocational education in this country, the primary source for employing trade and industrial teachers (and technical and health occupations teachers) has been industry itself. The professional education of these teachers has been through one of the four methods described by Beidel. The states developed their own qualification and certification processes and often conducted the teacher training without benefit of colleges and universities. Neither postsecondary preparation in the liberal arts or college-level training in pedagogy were prerequisite to teaching, nor were they necessarily considered desirable.

It is important to note, however, that the primary route for teaching in other subject areas identified with vocational education—either in more generic aspects of the subject (career education, consumer and family living, middle school exploratory programs, business subjects, technology education) or in the more traditional program areas (agricultural education, home economics, business education)—is with a bachelor's degree in the subject to be taught, *some* education courses, and *some* occupational or applied experiences (either on the job or under controlled or supervised laboratory conditions). It is primarily in trade and industrial education (perhaps as many as 75 percent of T&I beginning teachers) and in health occupations (about 50 percent) that it is general practice to permit entry into teaching without benefit of a baccalaureate degree and some education courses (Lynch, 1991). In addition, there are some very specialized programs (e.g., child care, hospitality/tourism, food service, entrepreneurship) in just some states that one can begin to teach without benefit of a baccalaureate degree. However, it appears as though all states require at least an associate's degree to teach in these (relatively new) specialized programs.

There is wide variation in alternative certification requirements for vocational education teachers from state to state. Beginning teachers in 43 states may teach in T&I programs without any college credits but with considerable occupational experience (Duenk, 1989). Only two states (Wisconsin and Hawaii) require a baccalaureate degree for beginning trade and industrial teachers. Seven require an associate degree and five a baccalaureate degree for full certification.

The minimum requirement of trade experience for beginning T&I teachers varies from 2 to 9 years, with an average being about 4. A few states may require less than two years provided the beginning teacher has higher levels of college education attainment. Interesting, though, is that various demographic studies place the actual years of occupational experience of beginning trade

teachers as between 9 and 15. In some states and in many localities it is common practice to employ retirees from local businesses or industries into a second career in teaching in trade and industrial education.

Occupational experience for other vocational education subject areas, such as marketing education, ranges from 500 clock hours to about 3 years. Not all subjects (i.e., home economics and business education) require paid occupational experience. In fact, there are any number of opinion studies and rhetoric which claim that paid occupational experience should not be prerequisite to teaching (in at least some) vocational subjects, especially in business education. Nevertheless, most vocational education teachers seem to have acquired occupational experience, and nearly all school systems have a preference for employing vocational education teachers who have worked in business or industry.

In addition to years or clock hours of occupational experience, alternative certification for trade and industrial education teachers has typically included some form of competency assessment. According to Duenk (1989), there are 8 different types of evaluation in use among the 53 states and territories. The most common type of assessment is through licensure granted by the states. Thus, one who is licensed to practice his or her trade—such as cosmetology, nursing, auto mechanics, or plumbing—usually also qualifies to teach the trade in public schools. A second common method for occupational assessment is to require prospective or practicing vocational teachers to pass occupational competency tests offered through the National Occupational Competency Testing Institute (NOCTI). Anywhere from 12 to 18 states use NOCTI exams either for initial certification, for recertification within the first year of teaching, or for preservice teachers lacking work experience (L. G. Duenk, 1989; Dykman, 1993). Some states are simply flexible; one can be alternatively certified to teach in vocational education through a variety of permitted models. The one common denominator is that occupational competency must be satisfactorily demonstrated.

Empirical Evidence

This section of the report will review empirical evidence on the adequacy of occupational experience and competency for teaching in vocational and technical education. Examination of the extant literature and studies should provide evidence to enable informed decision-making about the use of occupational experience and/or competency assessment as alternatives to baccalaureate degrees and college preparation of vocational education teachers. Are vocational and technical education teachers better prepared in the workplace or in college?

At the onset, it may be important to note that all studies reviewed seemed to lack a collective theoretical framework—which defines well the concepts under investigation, provides benchmark data for subsequent findings, and allows comparisons among related studies. Thus, these studies—without a theoretical framework—are eclectic; research questions, variables of interest, even definitions of teacher effectiveness were chosen because of the researcher's personal interests. There is no established relationship among these studies, they generally do not point to a common problem, and few connect data from one to another.

Further, empirical studies are scarce, quite dated, and those that are available are not particularly conclusive on the subject of occupational experience/competency and teaching effectiveness. Most studies collect data through surveys and provide only descriptive information. Both survey and empirical studies are fraught with design error, examine limited populations, tend to focus on trivia, are based in perception or opinion, and provide more in the way of descriptive information than

data to answer substantive questions. Rating instruments apparently do not discriminate sufficiently between "good" and "not so good" teachers or "high achieving" and "not so high achieving" students. Further, there is a definite bias which undergirds the studies; the bias being that occupational experience is and ought to remain the primary determinant of who is to teach in vocational education. Generally, the empirical connections between occupational experience and various effectiveness measures do not match the rhetoric and bias that says years of trade experience can substitute for a college degree and professional education. Nevertheless—and despite all of the above negative noise—some interesting work has taken place.

Occupational Experience and Administrator/Supervisor Ratings

No studies of the relation between occupational experience and teaching in vocational education took place before 1954. In that year, Rumpf asked secondary vocational administrators to identify superior teachers on their staff. By studying the traits of the 236 teachers, he concluded that years of occupational experience had little or no positive effect on administrators' performance rating of teachers; in fact, greater amounts of occupational experience appeared to have a negative effect. He found only two slight and positive correlations: rated performance improved with number of college credits earned ($r = .11$) and increased teaching experience ($r = .36$). Nine years later, Storm (1965) found similar results. Using survey data from 138 technical school administrators in 38 states, Storm concluded that "high success" technical instructors had more advanced degrees in education and 5.1 less years of occupational experience than "low-success" instructors.

Four other studies, from 1968 through 1973, supported the conclusions of Rumpf and Storm. These studies, although with diverse populations and methodologies, reported on supervisors' or teachers' self-ratings of teaching success factors. As reported by Whitener (1981) and Wilson (1984), authors of these four studies concluded that work experience beyond the minimum requirements of two to four years had no positive effect on teacher success.

Only one study (Swartz, 1974) found a significant effect of trade experience with teacher competency as rated by administrators of Virginia's T&I teachers. Interestingly, though, Swartz found no significant differences in the ratings by administrators, supervisors, teacher-peers, students, and self by combining trade experience, teaching experience, and professional education. Most recently, Mullins (1993) concluded that the immediate supervisors' ratings of Virginia T&I teachers was not dependent upon the variable of years of trade experience (nor, for that matter, on such other variables as teaching experience and professional education).

Occupational Experience and Student Achievement

Kapes and Pawlowski (1976) correlated several factors about T&I teachers with student achievement as measured by the Ohio Trade and Industrial Achievement Tests. "It is important to point out that [teachers'] industrial experience...yielded either no relationship or a small negative relationship with student shop achievement" (p. 10). The authors concluded, "since many years of teacher industrial experience do not improve student shop achievement...it may be necessary to minimize industrial experience as a criterion for teacher certification, or at least consider other competencies more important" (p. 11).

Two studies, both completed in Ohio in the 1960s, produced evidence to favor occupational experience as a positive factor in student achievement. The Industrial Materials Laboratory, Ohio

State Trade and Industrial Education Service (1965), and Shoemaker (1971) found a relationship between student achievement in auto mechanics, machine shop, printing, and the number of years the instructor had spent in the occupation prior to becoming a teacher. It is interesting to note, however, that at least two subsequent reviewers of these studies have questioned their conclusions due to a lack of collaborating data. For example, Wilson (1984) comments: "No data or statistical evidence...was provided in the study" to warrant such a statement as "teachers' industrial experience was a significant, positive factor relating to student achievement" (p. 26).

Several studies (Welch & Garner, 1976; Covey, 1973; White, 1971) also found that some occupational experience did produce positive results in student achievement, but that increased occupational experience on the part of the teacher produced decreased performance on the part of the student. Thus, the relationship between the teachers' occupational experience and their students' performance is nonlinear.

Occupational Competency Examinations (NOCTI and State)

The National Occupational Competency Testing Institute (NOCTI) is a nonprofit organization, headquartered at Ferris State University in Big Rapids, Michigan. According to Whitener (1981 and in personal communication, 1994), NOCTI provides high-quality occupational competency examinations on a national level. Each examination has two parts: a written test that measures technical knowledge required in the occupation and a performance test that measures skills typical of the occupation. The services at NOCTI include test development, revision, updating, and scoring, plus job and task analyses that lead to test development. NOCTI occupational competency examinations are the most widely used tests for trade and industrial teachers in the United States.

NOCTI administers 56 occupationally specific exams, ranging from air conditioning, heating, and repair to welding. Others include, for example, the most frequently administered exams: auto mechanics, carpentry, cosmetology, industrial electrician, machine trades, electronics technology, printing, and quantity food preparation.

In addition to establishing occupational competency and meeting state requirements for teacher certification, colleges and universities grant credits for successfully completing NOCTI teacher tests. According to the most recent survey data (1989), 92 colleges and universities in 43 states grant from 9 to 45 semester hours of credit for persons who successfully complete a NOCTI teacher test(s). Thirteen states use the national mean as their cut-off score for "passing" the NOCTI test; 11 use the national mean minus one standard deviation, 4 grant "passing" to anyone who scores above the 40th percentile on the national norms, and other variations are used by 11 states. Norms are updated each time tests are scored. National data are not available on the number who "pass" the exam nor on the number of retakes. One large state (Michigan) reports a 17 percent retake group.

Eighteen states require NOCTI tests for either initial certification, to recertify within the first year of teaching, or for preservice teachers who lack work experience. In addition, two states use their own tests and two more are considering requiring NOCTI exams as a condition for continued employment. In most cases, a candidate pays the fee (an average of $238) to take the exams. A total of 14,576 persons have taken the test since 1975, an average of 767 per year.

As stated in interviews and correspondence with the director and assessment specialist of NOCTI (Whitener, personal communication, December 1993 and January 1994; Rupe, personal

communication, January 1994), no relationships between teachers' occupational test scores and subsequent performance of teachers or their students have been ascertained. There are no predictability studies. It is curious that so little research has been done on scores on NOCTI exams and any relationship they may have to quality measures of vocational education students and programs. NOCTI does collect information on each examinee about the number of years of work experience, grade or education level completed, and the number of years of teaching experience (if any) prior to taking the exam. No correlations on these variables with teacher scores, student achievement, or teacher performance have been done at NOCTI nor apparently at its area testing service centers.

In the early 1980s, Whitener (1981) and Stewart (1984) completed dissertations using NOCTI test scores. Whitener found differential results using scores of a sample of 1,556 persons who had taken the examination from 1974 to 1980 in four specialized occupational areas: auto mechanics, carpentry, machine trades, and quantity food preparation. His general conclusion, "It is apparent that occupational competency is related in different degrees to occupational experience, teaching experience, educational level, and their aggregate. There is evidence that these relationships vary from occupation to occupation" (p. 159). Some occupations had no relationship. Based on his data, Whitener suggests that these variables not be used for teacher selection and certification.

Stewart (1984) correlated occupational competency with such variables as job satisfaction, job satisfactoriness, demographic characteristics, and self-ratings by teachers. His population consisted of 155 Georgia secondary and postsecondary trade and industrial teachers who had passed NOCTI examinations as a condition of their employment during a two-year period, 1981–82. The teachers' average age was 39, and their average occupational experience included 11.5 years. The Minnesota Satisfaction Questionnaire and Minnesota Satisfactoriness Scale instruments were used to gather data from and about the teachers. Stewart found no reliable relationships among job satisfaction, perceived job satisfactoriness, written and performance occupational competency tests, age, teaching experience, teaching level, and occupational experience in the population. He concluded that the relationship between occupational competency and job satisfactoriness was not sufficiently strong to reliably predict job satisfactoriness with measures of NOCTI occupational competency nor occupational experience.

Wilson (1984) reported on three state studies conducted in Pennsylvania in the 1960s and 1970s. The authors investigated the relationship between years of occupational experience and scores on Pennsylvania's state-developed occupational competency examinations. One study investigated degreed teachers (with less than five years of occupational experience) and nondegreed teachers (mean of more than 14 years of occupational experience). All three studies concluded that years of occupational experience did not correlate with higher occupational test scores. In fact, in some occupational areas, there appeared to be a negative correlation between years of occupational experience and occupational competency examination scores.

Occupational Experience vs. Education Tests/Credits/Degrees

Doerfort (1989) compared two groups of beginning T&I and agricultural education teachers, one prepared through an industry route and one prepared through traditional teacher education programs, with their results on the National Teacher Examination Core Battery Tests. Those teachers prepared through teacher education scored higher on the communication skills, general knowledge, and professional knowledge components of the test. The amount of professional education received accounted for the largest portion of variance in each of the dependent variables.

As cited earlier, Rumpf (1954) and Storm (1965) found positive correlations between college credits and others' ratings of T&I teachers' success, although they did not find positive correlations between the ratings and occupational experiences of teachers. Similarly, Kapes and Pawlowksi (1976) found college credits of T&I teachers to be moderately related with student achievement.

Beidel (1993) extracted data from the 1989 report of the Public School Teacher Questionnaire of the Schools and Staffing Survey for trade and industrial education teachers (identified in Item 27a of the survey). He compared nondegreed and degreed teachers on their self-reported responses to information about current teaching load, perceptions and attitudes toward teaching, and incentives and compensations received. The population of 495 included 184 (44 percent) nondegreed teachers. There were some differences between nondegreed and degreed trade and industrial education teachers, but they tended to be low statistically and probably unimportant. Beidel did find that degreed teachers are more satisfied with their class size and felt they had greater control of the instructional process than did nondegreed teachers. "Degreed teacher may be better prepared for the average number of students in a class and develop curriculum reflecting these needs prior to teaching" (p. 76). However, both groups tended to "agree" and "disagree" with statements at about the same level. Study data might have been more relevant and helpful had it compared trade and industrial education teachers with the teacher population as a whole, and with other vocational education subject areas.

Johnson and Summers (1993) recently analyzed 17 studies that examined various characteristics of the schooling experience and subsequent labor market performance of those schooled. The studies all controlled for relatively "hard" data measures of labor market outcomes, labor characteristics of students after they left high school, and quality measures of the school and school experience. The studies used fairly sophisticated statistical techniques (multiple regression analysis, large sample size, and a range of control measures). The authors concluded that the most significantly positive coefficients describing the quality of teachers were descriptive of their education, simply "better-educated teachers produce more effective employees" (p. 13).

Two studies cited by Johnson and Summers (1993) seem particularly relevant for purposes of this paper: Card and Krueger (1992) and Wachtel (1976). Using multiple regression techniques, Card and Krueger analyzed several census, education, labor, and personal income data sets containing information on 1,019,746 white men born from 1920–49. All were working in 1979—approximately 21–41 years out of high school—and kept a log of their weekly earnings during that year. An important finding for purposes of this paper is that the rates of return on labor market outputs were better for individuals from states with better-educated teachers and, incidentally, with a higher fraction of female teachers (Johnson & Summers, p. 31.)

Using several data sets and a recursive model (run with and without school quality measures, defined by expenditures per district), Wachtel analyzed the post high school achievement of 1,812 public school educated men whose mean age in 1969 was 47 and whose incomes in 1958 dollars were determined to be between $4,000 and $75,000. Regressions using alternative measures of school quality found "evidence that school quality affects the rate of growth of earnings" (p. 48) and one of the quality affects was that "better-educated teachers produce more effective employees" (p. 13).

Interesting is that, in general, Johnson and Summers found high quality vocational education as having a number of positive results for high school graduates who go directly into the labor force upon graduation. These authors suggest that policy groups focus on identifying the common characteristics of effective vocational education programs. Cumulative evidence in the Johnson

and Summers analyses suggests there is a significant and positive relationship between better educated teachers, effective vocational education, and the subsequent earnings and performance of students. They conclude that better teachers do a better job of preparing students for the world of work and that the most important measurements for better teachers are increased education and salary (pp. 14-15).

Teacher Training for Alternatively Certified, Beginning Vocational Education Teachers

As discussed earlier, Beidel (1993) outlined four types of instructor training programs which have historically been offered for vocational education teachers, primarily in trade and industrial education, who are alternatively certified. The fundamental intent is to provide "survival training" to those with limited or no formal teacher training, college education, or recent experience with public education. The challenge to state and local school administrators has been to design beginning teacher induction programs that will reduce the many problems confronting first-year teachers and to help them experience success in the classrooms. Has it worked?

Some of the more interesting and comprehensive studies with beginning vocational education teachers, including those prepared through traditional teacher education and those entering teaching without teacher education (i.e., but with considerable occupational experience), were conducted during the late 1980s and early 1990s by Heath-Camp and Camp for the National Center for Research in Vocational Education, The University of California at Berkeley.

Camp and Heath-Camp (1988 and 1989) and their colleagues originally laid out their research agenda to study the nature, dynamics, and scope of the induction process for beginning vocational education teachers. They define the induction process as a "culmination of experiences that lead the beginning teacher eventually to become successful, comfortable and confident in teaching or to exit the profession" (1988, p. 14). They were particularly curious about induction programs for vocational education teachers who are beginning to teach without benefit of teacher education.

Using beginning vocational education teachers as their subjects and focus, these two researchers and their colleagues analyzed the literature from 1933 to present, conducted in-depth focus group and individual interviews, analyzed daily/weekly tape-recorded logs, observed participants, reported qualitative data from five case studies, collected survey data from a national stratified random sample of 352 vocational education teachers in 15 states who began to teach during the 1989–90 school year, and examined and reported on exemplary induction programs. About 43 percent (N = 149) of the national sample of respondents were alternatively certified. Among their findings of relevance for purposes of this report and as reported in various monographs, journal articles, and reprints:

- Within the first year, 15 percent of all teachers quit, and within six years, more than half leave the profession (Heath-Camp and Camp, 1990a, p. 22).
- For nondegreed, postsecondary and adult teachers, 48.2 percent leave during their first five years of teaching (Heath-Camp & Camp, 1990b, p. 6).
- Nondegreed and alternatively certified teachers tend to be much older than those prepared through college teacher education programs, but have considerably more occupational experience. Those studied averaged an age in the mid-30s, were married with children, and had over 10 years of occupational experience (range from 5 to 35) (Heath-Camp & Camp, 1990b, p. 7).

- All beginning teachers seemed to hold unrealistic expectations when beginning to teach, but the experiences were quite different for alternatively certified teachers. They expected to be treated as professionals by school systems and expected students to understand the importance of vocational preparation and to be interested and self-motivated. "The realization that both sets of assumptions were incorrect provided a rude awakening" (Camp & Heath-Camp, 1991, p. 18).
- All beginning teachers have problems, but vocational education teachers entering the profession directly from business and industry with little or no pedagogical training have additional problems. In addition to not having experienced the classroom as a teacher under someone else's close supervision (i.e., through student teaching or internships), they are unfamiliar with curriculum, lesson planning, vocational student organizations, "red tape" of the school, and the misbehavior of students (Heath-Camp & Camp, 1990b, p. 14).
- Many alternatively certified teachers know nothing about curriculum or even what the word means. They feel the need for more orientation, help, and time to learn the curriculum and prepare for lessons. But their number one need was for a mentor in their subject area (Heath-Camp & Camp, 1990a, p.23).
- Alternatively certified teachers experienced fewer vocational-technical specific problems than those with traditional teacher education. They were more sure of their own ability, but very insecure in their relationships with other members of the education system at large (Camp & Heath-Camp, 1992).
- Generally, beginning teachers aren't getting much help. Only 25.5 percent from the national survey reported involvement in a beginning teachers' assistance programs; slightly more than half (56.2 percent) were helped by mentors or "buddies." The data are slightly better for alternatively certified teachers; 28.9 percent were involved in a beginning teacher assistance program, and 66.4 percent had a mentor (Heath-Camp & Camp, 1992, p. 42).
- There is little practical difference in the kinds of assistance received or in the perceived impact of the assistance received between beginning teachers with teacher education preparation and those who are alternatively certified (Camp & Heath-Camp, 1991, p. 15).
- Most beginning teachers experience severe frustration, especially during the first few months in the classroom. They experience an "unbelievably complex set of problems and successes" (Heath-Camp & Camp, 1990a, p. 22). Alternatively-certified teachers especially need early intervention in curriculum and pedagogy, but aren't getting it (Camp & Heath-Camp, 1991).
- School systems themselves contribute enormously to the negative influences in the work of beginning vocational education teachers. They tend to inject impediments for the novice to overcome. There is low level interaction between the beginning teachers and their co-workers (Camp & Heath-Camp, 1991, p. 9).
- "Even the most fundamental induction assistance needs are not being met by an alarming proportion of beginning vocational teachers" (Heath-Camp & Camp, 1992, p. 46). The authors point out, for example, that nearly 25 percent of beginning teachers are not given curriculum guides nor provided with any feedback or evaluation. Workshops for new teachers were provided for less than 50 percent of the respondents (Camp & Heath-Camp, 1991; Heath-Camp & Camp, 1992).
- Formal induction programs for beginning vocational education teachers are important and, where effectively offered, have an impact on beginning teachers. Having the most impact are practices such as providing a mentor or buddy teacher, adequate teaching materials, planning

time, and clerical support and assistance from a teacher's aide. Unfortunately, too few schools provide induction assistance or mentors (Heath-Camp & Camp, 1992).

- Nevertheless, there are promising exemplary programs throughout the country that are committed to assisting beginning teachers. These innovative programs include mentors, inservice training, time to reflect on and discuss with colleagues the connections between theory and practice, and other characteristics generally identified with effective induction practices. Interesting is that most beginning teacher assistance programs are available for all teachers in a geographical area or school system, regardless of subject field (Heath-Camp, Camp, Adams-Casmus, Talbert, & Barber, 1992). This may not be the most appropriate induction program for beginning vocational education teachers giving the finding by Camp and Heath-Camp (1992) that "almost one fourth (24.8 percent) of all problems reported by the first-year vocational teachers were attributable to the unique characteristics and requirements of vocational education" (p. 36).

Conclusions

The following conclusions are offered based on the collective evidence provided in this paper. The reader is reminded again of the many caveats provided about the lack of a collective theoretical framework and the quality and consistency of research design underlying the various studies reviewed. Nevertheless, the following are offered for the reader's perusal:

1. Nearly all vocational and technical education teachers have acquired paid occupational experience as a prerequisite to employment in vocational education. The minimum required for any vocational education field may be as few as 500 clock hours of university-supervised experience (e.g., in marketing education as part of a college teacher education major) to as much as nine years of occupational experience (e.g., in trade and industrial education in lieu of college-level preparation).

2. In some states there are subject areas identified with vocational education where paid occupational experience isn't prerequisite to teacher certification or employment. However, teachers have had considerable applied experiences in college laboratories and classrooms in processes identified with occupational competence in areas such as computer applications, office systems, technology, drafting (CAD and CAM), child care, and accounting. Even in these states and in these subjects, preference in employment is given to those with paid occupational experience.

3. For some subjects (trade and industrial education and health occupations in particular), occupational experience replaces state requirements for a college degree and college-level preparation in a subject area, the liberal arts, and in pedagogy. Years of occupational experience provide "alternative certification" in some subject areas of vocational education.

4. The belief that occupational experience is prerequisite to teaching an occupational specialty is heavily grounded in vocational education history and philosophy.

5. The National Occupational Competency Testing Institute (NOCTI) provides a source for nationally-developed, occupational competency assessment that is used by many states as a basis to certify the occupational competency of vocational education teachers for as many as 56 specialized occupations.

6. No reliable correlation has been established among scores on NOCTI or state-developed occupational competency tests and such variables as teacher qualifications, teacher satisfactoriness, or teaching effectiveness.

7. Some occupational experience is helpful—especially to novice teachers. It gives them a context and confidence in which to teach their occupational specialty. Extensive occupational experience has no effect on teaching effectiveness in contemporary vocational education programs.

8. Better educated teachers produce better educated workers for our nation's workplaces. As a corollary, better educated vocational education teachers and effective programs enrich the post-graduation earnings and workplace performance of graduates.

9. The collective findings from research on beginning vocational education teachers and the process used by public schools to induct them into the profession are dismal. Primarily, there is too little assistance for beginning teachers, especially in areas they perceive as having the most impact (e.g., mentors, adequate teaching materials, extra periods to plan, clerical assistance, and a teacher's aide).

10. All beginning teachers have problems, but alternatively certified vocational education teachers have additional problems. They are not getting much help in solving these problems. Apparently, the four types of induction and teacher training programs provided for alternatively certified vocational education teachers (as discussed by Beidel, 1993) are not in effect in any macro sense. Large numbers of alternatively certified teachers—a vast majority of the population—are being left to fend for themselves and to solve their own problems without benefit of a formal assistance program.

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Curricular Tracks and High School Vocational Education

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Abstract

High school reformers have recently raised important questions about the effectiveness of vocational education. Does it work? Does it provide adequate preparation in basic academic skills? Does it keep students in school? Or would everyone's needs be better met in one-track academically oriented schools? Existing reviews of grouping and tracking research do not provide an answer. Most of the reviews barely mention vocational education, but focus instead on differences between upper-and lower-track academic classes or on differences between academic and nonacademic programs.

The emphasis in this review is on the vocational track. The goal of the review is to draw conclusions about the academic effects of vocational education from an examination of all the relevant research results. The method used in integrating the research findings is quantitative, or meta-analytic. Conclusions are therefore based on a systematic search of the literature on vocational education and a statistical analysis of the coded results of the studies.

The results of the analysis provide support for four major conclusions about high school programs in vocational education. First, participation in vocational programs increases the likelihood that non-college-bound youngsters will complete high school. The results suggest that participation decreases the dropout rate of such youngsters by about 6 percent. Second, participation in vocational programs has at most a small effect on student mastery of basic academic skills. Students who complete vocational programs would not score higher on tests of academic skills if they instead completed general programs, but vocational students might score slightly higher if they completed a full program of academic courses. Third, students from vocational programs would be only slightly more likely to pursue postsecondary education if they pursued other curricular programs in high school. Fourth, graduates of vocational programs seem to be more satisfied with their jobs than are comparable students from other high school programs.

Introduction and Purpose

High school reformers used to encourage school systems to develop comprehensive high schools with an academic track for college-bound students, a vocational track for students headed for jobs, and a general track for students with less definite goals. But many school reformers see things differently today. They view tracking as a major problem in modern education and some advocate the complete de-tracking of American high schools.

Adler and his colleagues, for example, termed a multi-track system of schooling an abominable discrimination (Adler, 1982). Their Padeia proposal recommended the replacement of multi-track schooling with a system in which all students would follow the same course of study and pursue the same goals, no matter what their native ability, individual temperament, or conscious preference. Boyer (1983) also recommended abolition of the three-track system of academic, general, and vocational courses and endorsed the notion of a single track that provided a general education for all. Goodlad (1984) concurred with these proposals. He recommended that schools provide a common core of courses for students and randomly assign students to classes.

The reformers have been especially concerned about what goes on in the lower, or vocational, track in high schools, and they have singled out this track for special criticism. Boyer (1983) concluded that vocational education shortchanges students academically and does not prepare them adequately for careers. Goodlad (1984) wrote that vocational education is anachronistic since it prepares students for the mechanical age of the past rather than the technological era of the future. Oakes (1985) concluded that vocational education restricts access of minority students to future opportunities. She believes that vocational programs do not serve the democratic ends most Americans want their schools to achieve.

The de-tracking movement has gathered influential supporters in recent years. Oakes (1992) noted that the National Governors' Association (1990), the Carnegie Council on Adolescent Development (1989), and the College Board support de-tracking. She also noted that the National Association for the Advancement of Colored People, the American Civil Liberties Union, and the Children's Defense Fund have been examining possible segregative effects of tracking and that school systems in many parts of the country are revising their educational programs to eliminate curricular tracks.

The questions raised by the reformers are too important for vocational educators to ignore. Are disproportionate numbers of minorities and poor children shunted into the vocational track? Do they receive an inferior education there? Are they taught low-status subjects from inadequately prepared teachers? Would everyones needs be better met in one-track schools?

A single report cannot address all the issues, and this report is no exception. The goal of this report, however, is a broad one. It is to examine the existing research results on educational outcomes of vocational programs. I have not collected new data for this report, but instead I have collected and analyzed previously reported findings. The method I used to integrate the findings is quantitative, or meta-analytic. A meta-analysis is a statistical analysis of the results of other analyses. Meta-analysts use objective methods to find all the studies of an issue that they can. They describe features and outcomes of the studies in quantitative or quasi-quantitative terms, and they use statistical methods to determine whether a relationship exists between study features and study findings.

It is important to note that my review focuses on outcome not process studies of vocational education. Outcome studies examine results of programs; process studies look at how results are

achieved. I focused on outcome studies because they provide direct and essential evidence about the charges that have been leveled against vocational education. To decide whether vocational education shortchanges students, we must first know what its results are and whether they differ from results of other programs. How results are produced is also important to know, but it is not the first consideration.

Researchers studying vocational education usually distinguish between labor-market and educational outcomes. Labor-market outcomes include employment status, occupational prestige, earnings, and so on. Educational outcomes include individual growth in cognitive and affective areas. I consider only educational outcomes in this review. Although labor-market studies produce important evidence on vocational education, the information is not so critical for recent arguments made by de-trackers. The case against tracking is based on its educational effects not labor-market outcomes. In addition, other reviewers have examined the literature on labor-market outcomes of vocational education. Few reviewers have carefully examined the literature on educational and psychological outcomes.

The research studies that I located for this review analyzed such educational and psychological outcomes as knowledge gained by vocational students, their development of self-esteem, growth in citizenship, attitude changes, and so on. I examine only four outcomes in this report: completion of high school, cognitive growth, educational attainment, and occupational satisfaction. These are the four educational outcomes that Jencks (1972) examined in his classic book *Inequality*, and they are the educational outcomes examined most often by researchers studying vocational education.

I have organized the remainder of this report into six sections. I describe in section 2 the findings of authoritative reviews of research on tracking. The reviews I examine cover ethnographic, survey, and experimental studies of tracking and grouping. I critically examine the conclusions of these reviews and give special attention to the relevance of the conclusions to vocational education. My primary goal in section 2, however, is to provide a background for an in-depth examination of studies of tracking and vocational education.

I carry out this in-depth examination of educational outcomes of vocational programs in sections 3 through 7. Section 3 focuses on high school completion. My goal in the chapter is to determine whether vocational programs help keep high-risk students from dropping out of school. Section 4 examines student achievement in vocational programs. My purpose there is to determine whether students learn as much in vocational programs as they would if they were moved into other curricular programs.

I examine the educational attainments of vocational and nonvocational students in section 5. The chapter reviews evidence relevant to the claim that enrollment in a vocational program in high school reduces a student's chances of enrolling in college. In section 6, I review studies of job satisfaction to determine whether students from vocational programs are more satisfied with their jobs than other students are. Finally, in section 7, I draw four major conclusions from my review and analysis of studies of tracking and vocational education.

Research on Grouping and Tracking

De-trackers cite three kinds of studies to support their case against tracking. The first type of study is ethnographic or observational. Ethnographic studies provide narrative descriptions of classroom processes in upper- and lower-track classes. The second kind of study is the survey analysis. Researchers carrying out survey studies often use regression methods to determine how

track placement influences students. The third type of study is the experimental comparison. Experimental studies examine educational outcomes for equivalent students assigned to ability-grouped and non-grouped classes.

Reviewers have recently examined the findings from each of these research traditions (Gamoran & Berends, 1987; J. Kulik, 1992; Slavin, 1987, 1990b). In this chapter, I critically examine the review findings and the conclusions that have been drawn from them. I also try to determine how relevant the findings are for vocational education. My overall goal is to provide a background for later detailed examination of studies of tracking and vocational education.

Ethnographic Studies of Tracking

The earliest ethnographic studies of tracking examined behavior in British streamed schools (Ball, 1981; Lacey, 1970; Hargreaves, 1967). Later influential studies focused on American schools and classes (Oakes, 1985; Page, 1991; Rosenbaum, 1976). Although some ethnographic studies include quantitative data, most provide only qualitative observations. Ethnographers seldom go beyond armchair analysis of their data. As Gamoran and Berends (1987) point out, ethnographers try to uncover the subjective meaning of events and patterns of life in schools through rational analysis of their observations.

Perhaps the best known example of ethnographic research on tracking is that reported by Oakes (1985) in her book *Keeping Track*. The observations were originally collected for a project that John Goodlad described in his 1984 book *A Place Called School*. They were made in 299 English and math classes (75 high track, 85 average track, 64 low track, and 75 heterogeneous classes) in a national sample of 25 junior and senior high schools. The observations covered course content, quality of instruction, classroom climate, and student attitudes in each of the classes.

Oakes saw a pattern in the results. Instruction usually seemed to be better in the higher tracks. She reported, for example, that the percentage of time spent on instruction was 81 in high-track and 75 in low-track English classes; percentage of time spent on instruction was 81 for high-track and 78 for low-track math classes. Percentage of time off-task was 2 for high-track and 4 for low-track English classes; it was 1 for high-track and 4 for low-track math classes. More time was spent on instruction and less time was spent off-task, therefore in the high tracks.

Oakes (1985) also reported that there were curricular differences in high- and low-track classes. She reported, for example, that low-track classes covered less-demanding topics, whereas high-track classes covered more complex material. High-track teachers also seemed to encourage competent and autonomous thinking, whereas low-track teachers stressed low-level skills and conformity to rules and expectations. Oakes did not provide quantitative data to support these observations, however.

Gamoran and Berends (1987) have summarized the main results from the ethnographic studies of Oakes and others. They report that ethnographers have reached four main conclusions. (a) Instruction is conceptually simplified and proceeds more slowly in lower tracks. (b) More experienced teachers and those regarded as more successful seem to be disproportionately assigned to the higher tracks. (c) Teachers view high-track students positively and low-track students negatively. (d) Most of a student's friends are found in the same track.

An important point to note is that ethnographers seldom quantify their observations. It is often hard to tell therefore whether the differences they find between upper and lower tracks are large or small. In a few cases, however, ethnographers have quantified their observations. The results

suggest that the differences may be small. Gamoran and Berends (1987), for example, noted that Oakes reported only a 2 or 3 percent difference in time off-task for upper and lower tracks. They noted that this difference is not large, and in most respects, track levels appear to be much more alike than they are different.

More important, it is difficult to tell whether differences in behavior in upper and lower track classrooms are student- or teacher-produced. Slavin (1990a) makes this point

> "On the quality of instruction issue, the variables typically found to differentiate high- and low-track classes are ones that cannot be separated from the nature of the students themselves. For example, many studies find that there is less content covered in low-track classes. But is this by its nature an indication of low quality? Might it be that low-track classes need a slower pace of instruction? The whole idea of ability grouping is to provide students with a level and pace of instruction appropriate to their different needs. Similarly, time on-task is found to be lower in low-track classes. Might it be that low-achieving students are more likely to be off-task no matter where they are?" (p. 505).

Even in heterogeneous classrooms, low-achieving students might spend less time on-task than high-achieving students do. Even in heterogeneous classrooms, low-achieving students might cover less content than high-achieving students do. Without observations of heterogeneous classrooms, it is difficult to know which classroom behaviors are student-produced and which are teacher-produced.

We could determine whether the differences were student- or teacher-produced if we had control data, but ethnographers seldom provide such data. When such data are available, they are usually illuminating. For example, some ethnographers have observed that self-esteem is low in lower-track classrooms, and they have concluded that tracking produces this low self-esteem by stigmatizing students. With control data available, we can see that the conclusion is unwarranted. Controlled studies have examined the self-esteem level of children in mixed-ability classrooms as well as tracked classrooms, and these studies have usually found that the self-esteem of lower aptitude children goes down even further when such children are taught in mixed-ability classrooms (Kulik, 1992). If anything, tracking seems to raise the self-esteem of lower aptitude students.

Lotto (1986) has noted an additional problem in applying results of these ethnographic studies to vocational programs. The ethnographic studies examine instruction in lower-track *academic* classes not in *vocational* classes. According to Lotto, instruction in vocational classes may be more similar to high-track academic instruction than it is to low-track academic instruction. She points out that teachers use a wide variety of instructional techniques in vocational classes, and there is use much less lecturing, questioning, quizzing, and seat-work in these classes than in other classes. In other words, teachers of vocational classes use instructional techniques that are usually endorsed by experts. Lotto also points out that vocational courses are among those that students like most. No one knows for sure whether instruction in vocational classes is more like upper- or lower-track academic instruction, but Lotto concludes that it is unfair to charge vocational courses with deficiencies found in lower-track academic courses.

For vocational educators, the yield from ethnographic studies must seem rather slim. The ethnographic studies show that the amounts of time on-task are different in upper- and lower-track classrooms, and there may also be differences in teachers, in teacher reactions to students, and in

instructional emphasis as well. One problem is that ethnographic studies do not show what lies behind these differences. Differences in instruction for fast and slower students may be appropriate adjustments, or they may reflect real differences in instructional quality in different curricular tracks. Observational research does not provide the answer. Another problem is that differences found in comparisons of upper and lower-track academic classes may not be found in comparisons of academic and vocational classes. At least some experts believe that quality of instruction is higher in vocational classes than it is in academic ones.

Regression Studies of Tracking

Regression studies of survey data on tracking address two main questions. First, what factors influence students to enroll in different curricular tracks? Survey researchers have been especially interested in determining whether academic ability or socioeconomic status plays a more important role in track placement. Second, how much do curricular tracks influence students? Researchers have explored the influence of tracks on such educational outcomes as high school achievement, postsecondary attainment, and self-esteem.

Garet and DeLany (1988) identified and reviewed the four most influential studies on student placement into curricular tracks. These studies are those of Alexander, Cook, and McDill (1978); Hauser, Sewell, and Alwin (1976); Heyns (1974); and Rosenbaum (1980). All of these studies have one thing in common. They divide the high school curriculum into only two tracks, the college preparatory track and the noncollege track. The studies do not separate the vocational track from the general track. Gamoran and Mare (1989) drew conclusions from the studies examined by Garet and DeLany and from their own analysis of High School and Beyond data.

Although estimates of the importance of ability, socioeconomic status, and other influences on track placement differ somewhat from one study to the next, the pattern of results is fairly consistent. Four points emerge from the studies reviewed by Garet and DeLany (1988) and Gamoran and Mare (1989):

- Personal preference seems to be the most important determinant of curricular track. In the Coleman Equal Educational Opportunity Survey (EEOS), about 84 percent of all high school seniors reported that they were in the high school curricular programs of their choice (Jencks, 1972). In the High School and Beyond (HSB) survey, the majority of youngsters (between 70 percent and 75 percent) reported that they made their own choice about their curricular track (Lee & Bryk, 1988). The percentage of vocational students reporting that they were free to choose their track was similar to the percentage of college preparatory students claiming that they had a choice.
- After personal preference, the next most important determinant of curriculum placement seems to be academic ability. The correlation between test scores and curriculum assignment is around 0.50 (Jencks, 1972), and youngsters who are 1 standard deviation above the mean in ability, have a probability of ending up in the college track about 20 percent higher than do students of average ability (Garet & DeLany, 1988).
- Social class plays a less important role in high school curriculum placement, except insofar as it influences test scores. All studies indicate that the direct effect of ability is larger than is the direct effect of socioeconomic status, but the importance of socioeconomic status varies across studies. Heyns (1974) found that a student with a father's education or occupation that is 1 standard deviation above the average, has a probability of ending up in the college track about

3 percent higher than does an average student; Rosenbaum (1980) reported that the probability is about 12 percent.

- Race and gender play a smaller role in track placement. Blacks have a higher probability of ending up in the college preparatory track than do whites of equivalent aptitude and socioeconomic status (Gamoran & Mare, 1989). Earlier studies showed that boys are more likely than girls to end up in the college track, but Gamoran and Mare's analysis of the HSB data set suggest that times have changed. Girls now appear to be more likely than boys to end up in college preparatory programs.

Results concerning the effects of track placement on achievement in high school are less clear. Gamoran and Berends (1987) reviewed results from 16 outcome studies that analyzed data from 10 national or state-wide surveys. Some of the studies found that a significant amount of variation in test scores was related to track membership, but others found a non-significant relationship between these variables. All of the studies of the question, however, found that there was a significant relationship between track membership and educational attainment after high school. That is, students who are in college preparatory programs are more likely to enroll in college than are equally able students from the general and vocational tracks. Gamoran and Berends do not report any other consistent findings from national surveys of high school students.

Reviewers have criticized the studies that produced these findings on methodological grounds. Most of the studies, for example, compared achievement of students in academic and nonacademic programs. The observed difference in aptitude of students in these programs is so great that attempts to equate the groups statistically may be futile. Slavin (1990a) has described the problem as follows:

> "In my article, I discussed at length the problems with these high-track/low-track studies. One problem is statistical; when groups are very different on a covariate, the covariate does not adequately "control" for group differences. To the degree that the covariate has a reliability less than 1.0, it tends to undercontrol for group differences, but even small differences in within-group slopes of the covariate on the dependent measure can cause major errors when there are large group differences (see Reichardt, 1979). When comparing high- to low-ability groups, pretest or covariate differences of one to two standard deviations are typical. No statistician on earth would expect that analysis of covariance or regression could adequately control for such large differences" (p. 506).

Another methodological problem that comes up in comparisons of academic and nonacademic students is the failure to take into account all differences between high- and low-track students. Slavin (1990a) has also described this problem clearly:

> "In addition, the logic of such comparisons is simply difficult to accept. Do students at Harvard learn more than those at East Overshoe State, controlling for SAT scores and high school grades? Are the San Francisco Forty-Niners better than the Palo Alto High School football team, controlling for height, weight, speed, and age? Such questions fall into the realm of the unknown. Comparing the achievement gains of students in existing high versus low tracks is not so different. Many factors go into track placement—achievement, behavior, attitudes, motivation, prior course selection, and so on-and each of these is likely to affect post-test achieve-

ment regardless of track placement. No study will ever adequately control for all these factors, and as a result studies comparing high to low track will always tend to show higher achievement for the high track students" (p. 506).

Beyond these methodological problems lie conceptual ones. Writers who cite regression results in arguments against tracking miss the point of the analyses. Regression analyses at best show what would happen to certain students in a track system if they were moved to another track. Regression analyses do not show what would happen if a track system were eliminated and replaced by something different. Effectiveness might be greater or less in an untracked system than in any of the tracks in a multi-track system. Slavin (1990a) has also written about this point:

> "However, this whole discussion is in many ways beside the point. Educators are not looking for research on whether students should be assigned to the high-, middle, or low-ability group. As long as the system exists, students will be assigned to these groups by some standard. What educators want to know is the effect of the system, compared to a plausible alternative. This is precisely the comparison made in 29 studies I have emphasized. In these studies, schools did exactly what many middle and high schools are considering: They untracked, either in selected subjects or across the board. The results were clear. Comparing ability grouped to ungrouped situations, there were no differences for high, average, or low achievers" (p. 506).

It would be wrong to conclude, however, that regression analysis should never be used with achievement data from tracked students. It is true that regression methods can produce misleading results when academic and nonacademic students are being compared. But regression results are far more trustworthy when vocational and general students are being compared because vocational and general students are similar in important characteristics that influence school outcomes. Comparisons of vocational and general students have seldom received much attention in reviews of research on curricular tracking, however.

Experimental Studies of Ability Grouping

Researchers have for many decades carried out experimental evaluations of tracked or ability-grouped classes. Slavin (1990a) has noted that these studies are the best guide that we have to the effects of tracking and grouping on students. In a typical study, a researcher assembles groups of learners who have been assigned to either ability-grouped or non-grouped classes. The researcher compares overall academic achievement in the ability-grouped classes and non-grouped classes, and the researcher may also examine effects of grouping on children at different aptitude levels.

One difficulty in drawing conclusions from the experimental literature arises from the variety of grouping programs. Such programs are not all the same. Differences among programs such as the following are too great to be ignored:

- *XYZ classes.* School personnel divide children in the same grade into groups—often high, middle, and low groups—on the basis of test scores and school records, and teachers teach the groups in separate classrooms either for a full day or for a single subject. The high, middle, and low classes in most programs use the same text materials and follow the same course of

study. The traditional name for this approach is XYZ *grouping*, but XYZ classes have also been called *multilevel*, *multi-track*, and *homogeneous classes*. Slavin (1987) calls the approach *ability-grouped class-assignment*.

- *Cross-grade grouping*. The best known approach to cross-grade grouping is the Joplin plan, which was first used during the 1950s for reading instruction in the Joplin, Missouri, elementary schools. During the hour reserved for reading in the Joplin schools, children in grades 4, 5, and 6 went to eight different classes where they received instruction at the appropriate reading level—anything from the grade 2 to grade 9 level–without regard to their regular grade placement.
- *Within-class grouping*. A popular model for within-class grouping of children in arithmetic was also developed in the 1950s. A teacher following the model would use test scores and school records to divide her class into three groups for their arithmetic lessons, and she would use textbook material from several grade levels with the groups. The high group in grade 6, for example, would use texts from grades 6, 7, and 8; the middle group would use texts from grades 5, 6, and 7; and the low group would use texts from grades 4, 5, and 6. The teacher would present material to one group for approximately 15 minutes before moving on to another group.
- *Enriched classes for the gifted and talented.* Students who are high in aptitude receive richer, more varied educational experiences in enriched classes than would be available to them in the regular curriculum for their age level.
- *Accelerated classes for the gifted and talented.* Students who are high in academic aptitude receive instruction in accelerated classes, and they are thus able to proceed more rapidly through their schooling or to finish schooling at an earlier age than other students.

Older reviews do not distinguish adequately among grouping programs, and as a result they do not always reach the same conclusions about grouping effects (Kulik, 1992).

Recent reviews, however, have made the necessary distinctions, and the reviewers have reached consistent conclusions about what the research says. Among the most comprehensive recent reviews are the meta-analytic investigations carried out by Robert Slavin at Johns Hopkins University (e.g., Slavin, 1987, 1990b) and those conducted by my research group at the University of Michigan (e.g., C.-L. Kulik & J. Kulik, 1982, 1984; J. Kulik & C.-L. Kulik, 1984, 1987, 1991, 1992). These meta-analyses show that different kinds of programs produce different effects. The key distinction is among (a) programs in which all ability groups follow the same curriculum; (b) programs that make curricular adjustments for the special needs of highly talented learners; and (c) programs in which all groups follow curricula adjusted to background and ability.

Grouping without curricular adjustment. The Michigan meta-analyses covered 51 separate studies of XYZ classes (J. Kulik , 1992), and the Johns Hopkins analyses covered 47 studies (Slavin, 1987, 1990b). Both analyses reached the same conclusion about lower and middle ability students: These students learn the same amount in XYZ or mixed classes. The evidence from the higher aptitude groups is less clear. The Michigan meta-analysis found that higher aptitude learners make slightly larger gains in XYZ programs. A higher aptitude student who gained 1.0 years on a grade-equivalent scale after a year in a mixed class would gain 1.1 years in an XYZ class. The Johns Hopkins meta-analysis suggested that gains for higher aptitude students are equal in XYZ and mixed classes.

Slavin (1990b) described effects of XYZ programs on secondary students as follows:

> "Comprehensive between-class ability grouping plans have little or no effect on the achievement of secondary students, at least as measured by standardized tests. This conclusion is most strongly supported in grades 7-9, but the more limited evidence that does exist from studies in grades 10-12 also fails to support any effect of ability grouping. ....For the narrow, but extremely important purpose of determining the impact of ability grouping on standardized achievement measures, the studies reviewed here are exemplary. Six randomly assigned individual students to ability-grouped or heterogeneous classes, and nine more individually matched students and then assigned them to one or the other grouping plan. Many of the studies followed students for 2 or more years. If there had been any true effect of ability grouping on student achievement, this set of studies would surely have detected it" (p. 494).

Why are the effects of XYZ grouping on student achievement so small? It may be because the curriculum is a key determinant of learning outcomes, and XYZ programs do not prescribe different curricular materials for the stratified classes. While school personnel are usually careful in placing children into XYZ classes by aptitude level, they seldom adjust the curriculum to the aptitude levels of the classes. For example, children in the high group in a grade 5 program may be ready for work at the 6th-grade level; children in the middle group are usually ready for work at the 5th-grade level; and children in the low group may need remedial help to cover 5th-grade material. All groups work with the same materials and follow the same course of study in most XYZ programs. XYZ programs are therefore programs of differential placement but not differential treatment.

Some of the studies of XYZ classes also examined student self-concepts. The Michigan meta-analyses, for example, covered 13 studies of grouping effects on self-esteem (J. Kulik, 1992). The *average* overall effect of grouping in the 13 studies was to decrease self-esteem scores by a trivial amount. The average self-esteem scores in XYZ and mixed classes were therefore nearly identical. Nonetheless, XYZ classes appeared to have a small effect on student self-esteem. The Michigan meta-analyses showed that self-esteem scores go up slightly for low-aptitude learners in XYZ programs, and they go down slightly for high-aptitude learners. Brighter children lose a little of their self-assurance when they are put into classes with equally talented children. Slower children gain a little in self-confidence when they are taught in classes with other slower learners.

Findings from studies of XYZ classes may be relevant to some courses taken by students in vocational programs. Like other students, vocational students take courses in core subjects such as English and math, but they sometimes find themselves in sections of these courses in which there are many other vocational students, but relatively few college-bound students. The homogeneous grouping may be the deliberate result of administrative planning or the unplanned consequence of scheduling of courses in vocational subjects. The findings on XYZ classes suggest that these homogeneous classes should not hurt vocational students academically, as long as the sections taken by vocational students follow the same curriculum as other classes do. Findings on XYZ classes also suggest that vocational students may feel slightly better about themselves and their abilities in these homogeneous sections than they would in mixed-ability sections.

Curricular adjustment for high-aptitude learners. The Michigan meta-analyses covered 23 studies of accelerated classes for high-aptitude learners (J. Kulik, 1992). The studies

compared the achievement of equivalent students in accelerated classes and non-accelerated control classes. All of the studies examined moderate acceleration of a whole class of students rather than acceleration of individual children. In each of the comparisons involving students who were initially equivalent in age and intelligence, the students in accelerated classes outperformed the students in non-accelerated classes. In the typical study, the average superiority for the students in accelerated classes was nearly one year on a grade-equivalent scale of a standardized achievement test.

The Michigan meta-analyses also covered 25 studies of enriched classes for talented students. Twenty-two of the 25 studies found that talented students achieved more when they were taught in enriched rather than regular mixed-ability classes. In the average study, students in the enriched classes outperformed equivalent students in mixed classes by about 4 to 5 months. Children receiving enriched instruction gained 1.4 to 1.5 years on a grade-equivalent scale in the same period during which equivalent control children gained only 1.0 year.

The strong effects of accelerated and enriched classes are probably due to curricular differentiation. In XYZ classes, curricular adjustment is minimal; in accelerated and enriched classes, it is maximal. In these classes, teachers introduce a good deal of above-grade-level material for students who are willing and able to meet the challenge. The test scores show the results. High-aptitude students benefit from taking these advanced classes, and they suffer when they are held back in regular classes.

Although these findings come from academic classes rather than vocational ones, they may be relevant for vocational educators. Vocational students take fewer advanced courses in mathematics, English, and in other academic areas than college prep students do. High aptitude students in vocational programs may therefore be at a disadvantage on standardized tests when compared to equally talented students in college-prep programs. Vocational students as a group may therefore perform less well on tests in the core subjects because high-aptitude vocational students ordinarily take fewer advanced and enriched courses than college-prep students do.

Curricular adjustment for all students. Both the Michigan and Johns Hopkins meta-analyses found that cross-grade and within-class programs in elementary and middle schools usually produce positive results (Kulik, 1992; Slavin, 1987). The Michigan analysis, for example, covered 14 studies of cross-grade grouping and 11 studies of within-class grouping. More than 80 percent of the studies of each type reported positive results. The average gain attributable to cross-grade or within-class grouping was between 2 and 3 months on a grade equivalent scale. The typical pupil in a mixed-ability class might gain 1.0 years on a grade-equivalent scale in a year, whereas the typical pupil in a cross-grade or within-class program would gain 1.2 to 1.3 years. Effects were similar for high, middle, and low aptitude pupils.

Cross-grade and within-class programs appear to work because they provide different curricula for pupils with different aptitude. In cross-grade programs, students move up or down grades to ensure a match between their reading ability and their reading instruction. In within-class programs, teachers divide students into ability groups so that all children can work on arithmetic materials for which they are properly prepared. Curriculum varies with student aptitude in both cross-grade and within-class programs. The programs thus differ in an important respect from most programs of XYZ grouping.

These studies are only indirectly relevant to vocational education. After all, none of the studies examined instruction in senior high school, and none examined grouping in vocational subjects. Nonetheless, the studies do suggest that separation of students into ability groups will produce

positive benefits for all students if the ability grouping is accompanied by appropriate curricular differentiation. These studies suggest that vocational and other tracks may produce positive benefits if the curricular tracking is used to provide students with instruction for which they are adequately prepared.

Conclusions from experimental studies. Different grouping and tracking programs produce different effects on student achievement. Some grouping programs do not raise student test scores above the usual levels, but others lead to moderate to large increases in student achievement. The programs that add little to student achievement are those in which all ability groups follow the same curriculum. Programs that have a moderate to large effect on student achievement are those in which groups follow curricula adjusted to their ability levels.

Less is known about the effects of grouping programs on student self-esteem, but experimental studies fail to support the charge that students in the lower tracks suffer irreparable damage to their self-esteem. Students in the high groups drop a little in self-esteem; students in low groups actually increase a little in self-esteem in ability-grouped classes. The finding is inconsistent with labeling or stigma theory, which predicts a drop in self-esteem for the groups with lower status. The finding is consistent, however, with predictions of social comparison theory. According to social comparison theory, people make self-evaluations by comparing themselves to those around them. The theory predicts that slow learners will feel more adequate in a slow-learning group and that fast learners will feel less special in a fast-learning group.

Conclusions

Advocates of de-tracking cite three types of studies to support the claim that curricular tracks have harmful effects on students. The studies are survey analyses of tracking, ethnographic studies of tracked classes, and experimental studies of ability grouping. Authoritative reviews of these studies do not support the claims of the de-trackers.

Authoritative reviews of national educational surveys suggest that the most important factor affecting student placement into tracks is the personal preference of the students. Between 75 percent and 85 percent of all students report choosing their curricular programs. The next most important influence on track placement is academic aptitude. Other factors, including socioeconomic background, gender, and race, play a less important role in track placement. The reviews also report one highly consistent effect of tracking: Enrollment in a college-prep track is related to college attendance. Students from college-prep programs are more likely to enroll in college than are equally able students from general and vocational programs. Educational surveys report mixed findings on student achievement, however. Some studies report that a significant amount of variation in test scores is related to track membership, but others report a nonsignificant relation between test scores and curricular track. Reviewers report no other consistent findings from regression analyses of tracking effects.

Although individual ethnographers have reported that the curriculum is debased, teachers are inexperienced, and instruction is poor in lower track classes, reviewers find little concrete evidence to support the charges. When ethnographers have quantified their observations, their reports suggest that differences between instruction in upper- and lower-track academic classes are small. What is more important, the interpretation of the differences is unclear. The slight difference ordinarily found in instruction in upper- and lower-track classes may reflect a difference in instructional quality, but it may also indicate that teachers make appropriate adjustments to the different needs of young people in the two types of classes.

Reviews of experimental studies show that different grouping or tracking programs produce different effects on students. Some grouping programs have little or no effect on student achievement, but others have moderate to large effects. The key distinction is between programs in which all ability groups follow the same curriculum and programs in which groups follow curricula adjusted to their background and ability. Programs in which all ability groups follow the same curriculum have little or no effect on student achievement. Programs in which curricular adjustments are made for the aptitude level of the students usually have moderate to large effects. Few of the experimental studies, however, examine effects on vocational students as a separate group.

The overwhelming impression that one gets from literature reviews on grouping and tracking, in fact, is neglect of vocational education. Reviewers of survey research usually fail to distinguish between general and vocational tracks. Instead, they lump general and vocational classes together into a single category of nonacademic classes. Reviewers of ethnographic studies examine instruction in upper- and lower-track academic classes, but not in vocational courses. Reviewers of the experimental literature cite relatively few studies of ability grouping at the senior-high level and seldom mention the topic of vocational education.

Reviews of the literature on tracking and grouping are therefore not as helpful as they should be to vocational educators. To draw conclusions about the effect of vocational programs, vocational educators cannot simply rely on existing reviews, but instead they must look more closely at the studies themselves. In the next four chapters, I provide some help in this task by describing and analyzing results from relevant studies. My purpose is to uncover findings that are more directly relevant to the field of vocational education.

High School Completion

Although the proportion of young people who finish high school has increased substantially during the past half century, many people think that today's dropout rate is still far too high. One reason for their concern is the total number of high school dropouts. Although 85 percent of young adults have been completing high school recently, compared to less than 40 percent in 1940 (Rumberger, 1987), still nearly 500,000 students drop out annually (Peng & Takai, 1983). The staggering number of dropouts places a great burden on social welfare programs for housing, health care, and employment, and the over-representation of minorities among the dropouts is a sad reminder that this country still has a long way to go to achieve equity among all its citizens.

Proponents of vocational education have long believed that vocational programs can help prevent high school dropout. Mertens, Seitz, and Cox (1982) cite an early instance of concern about high school dropouts:

> "By 1823, two years after the opening of the first publicly supported high school in America, 76 of the entering class of 176 had dropped out. The School Committee of the City of Boston, in response to this high attrition, recommended that the most useful and practical subjects should be offered in the first year . . . The use of occupationally relevant instruction to prevent high school dropout had begun. Unfortunately, how well this instructional change was implemented, or if the change helped to keep students in school, was never documented. Things have not changed a great deal in the past 150 years. Relevant education is repeatedly urged as a way to reach and retain poorly performing youth in school, but the utility of this approach has yet to be clearly demonstrated" (1982, p. 1).

Nor have things changed much in the past decade. In their study of dropouts, Mertens et al. (1982) found statistical support for the proposition that vocational programs keep students in school, but the size of the effect was too small to be of any practical significance. Catterall and Stern (1986) also judged their findings on dropouts from vocational programs to be inconclusive. Findings seemed to vary with the method used to identify vocational students and with the control variables used in an analysis. Statistics cited by the General Accounting Office (1986) and the National Center for Education Statistics (1985) seem to show no dropout-preventing effects for vocational education, but reviews by Lotto (1986) and Weber (1988) suggest that vocational programs may help keep young people in schools.

The whole area of curricular effects on high school completion is clearly worthy of more careful study. My purpose in this chapter is to give the existing research the attention it deserves. My plan is first to examine overall dropout rates by curricular program. I then examine studies that use statistical or experimental control to compare dropout probabilities for vocational and nonvocational students who are similar in background, aptitudes, and other factors.

Methodology

I located dropout studies in two places. My first source was a computerized search of the library data base maintained by the Educational Resources Information Clearinghouse (ERIC). I searched the full text of ERIC citations and abstracts from the years 1982 through September 1993 for the terms secondary education, vocational education, and dropouts. I located 99 documents that included these terms in citations or abstracts. I reviewed all the documents either in full or in abstract form, but found that relatively few described studies that were suitable for review in this chapter. My second source was the reference lists in the documents located in the ERIC search. I used these reference lists to find other relevant documents.

Through direct data-base searching and branching, I located a total of 8 usable studies (table 3.1). Each of the studies was a longitudinal, quantitative study that examined dropout data in a national or regional survey. Although the studies were thus uniform in several important respects, they also differed from one another in some key features. The most important of these were the ways in which they (a) identified vocational students, (b) formed comparison groups, and (c) analyzed the data.

Identification of vocational students. Most of the researchers relied on student self-categorization to identify vocational students. Peng and Takai (1983) used self-categorizations that students made during their sophomore year in high school. Coombs and Cooley (1968) relied on categorizations that students made in both 9th-grade and 12th-grade. Weber (1988) used 12th-grade self-categorizations, and Grasso and Shea (1979) relied on student self-reports made during follow-up surveys.

Other researchers identified vocational students from the courses that they took in high school. Catterall and Stern (1986) classified students on the basis of course work before the junior year and then examined dropout rates during junior and senior years. Mertens et al. (1982) noted the number of vocational courses that students took in grades 9, 10, and 11, and they tried to determine whether the number of such courses taken in a given year predicted dropping out during the succeeding year. Wagner (1991) used a similar approach. Perlmutter (1982) classified students as vocational or nonvocational at the beginning of high school from school records.

Table 3.1.—Description of eight studies on track differences in dropout rates

Study	Data collection	Data analysis
Catterall & Stern, 1986	High School and Beyond (HSB) surveyed a nationally representative sample of approximately 30,000 sophomores in public and private high schools in 1980. Approximately 15,000 of these students were surveyed in 1982 follow-up. Sample for this study comprised 2,739 students who as sophomores in 1980 resided in California and who completed the HSB follow-up survey in 1982.	Dropout rates by program. Vocational education activity was determined from courses reported in base survey by (a) participants vs. nonparticipants,and (b) concentrators vs. nonconcentrators. Dropout rates determined from follow-up survey.
Coombs & Cooley, 1968	Project Talent surveyed 440,000 students attending public & private high schools. Students tested as 9th graders in 1960 and again in a 1964 follow-up. Sample for this study was all known dropouts in the 9th-grade sample, plus a random subsample of 25 percent of the male and 20 percent of the female graduates who did not enter a 2-year or 4-year college.	Dropout rates by program. Classification of curricular program based on student answers to questions on 1960 base-year survey (intended curricular programs) and on 1964 follow-up survey.
Grasso & Shea, 1979	National Longitudinal Survey of Labor Market Experience (NLS–LME) surveyed two national samples of young people aged 14 to 24: 5,000 young men in 1966 and 5,000 young women in 1968. This study used interview data (through 1972 for women and 1973 for men) from those who were in high school in the base year of the survey.	Regression analysis. Curricular program determined from follow-up survey. Other predictor variables were aptitude, socioeconomic background, and residence. Dependent variable was completion of 12 or more years of school.

Table 3.1.—Description of eight studies on track differences in dropout rates—Continued

Study	Data collection	Data analysis
Mertens, Seitz, & Cox, 1982; Bishop, 1988	Data from the National Longitudinal Survey of Labor Force Behavior (NLS–Youth), a survey of a nationally representative sample of approximately 13,000 young people who were 14 to 21 years old in 1978. Sample used in this study were those with an above-average likelihood of dropout. Their 1979 and 1980 interviews, supplemented by high school transcripts, provided the data.	Regression analysis. Separate regression analyses conducted to determine whether taking vocational courses in Grades 9, 10, and 11 affected the likelihood of completing the next grade level. Analyses controlled for individual, family, contextual, and school variables.
Peng & Takai, 1983	Like Catterall and Stern (1986), this study used HSB data. The full data set was used in these analyses.	Dropout rates by curricular program. Curricular program was determined from student self-report in the base-year survey.
Perlmutter, 1982	Data from a city-wide study (Project Catch) carried out in New York City schools. Data collected from 2,700 students who had applied in the last year of intermediate or junior high in June 1976 to a NYC high school for either 9th or 10th grade. School records were examined and yielded matched groups of students: Targets (denied admission to a vocational high school), Vocational Controls (admitted), and Academic Controls (did not apply to vocational high). Three-year follow-up survey and school records provided additional data.	Quasi-experimental design compared dropout rates of (a) students admitted to vocational high schools, (b) matched students who were not admitted, and (c) matched students who did not apply. Matching was on basis of area of residence and academic aptitude.

Table 3.1.—Description of eight studies on track differences in dropout rates—Continued

Study	Data collection	Data analysis
Wagner, 1991	National Longitudinal Transition Study of Special Education Students (NLTS), a nationally representative sample of more than 8,000 students who were 13 to 21 and in special education in the 1985–86 school year. Data collected in 1987 from telephone interviews with parents, school records, and a survey of educators in the schools attended by the students.	Regression analysis. Vocational participation was determined by enrollment in occupationally oriented vocational education during the most recent school year. Other predictors in regression equations reflected individual, household, and school factors. Dependent variable dropout during follow-up period.
Weber, 1988	Like Catterall and Stern's (1986) study, this study used HSB data.	Dropout rates by track. Curricular program determined from student self-report in the follow-up survey.

Comparison groups. The simplest solution to the problem of comparisons is to list the dropout rates for academic, general, and vocational programs. Peng and Takai (1982) and Weber (1988) used this approach, and Catterall and Stern (1986) contrasted vocational students with all other students in the population. Other researchers compared dropout rates for vocational students to dropout rates of other restricted populations. Coombs and Cooley (1968), for example, compared dropout rates for vocational students to dropout rates for other students who did not go on to college. Grasso and Shea (1979) concluded that the best comparison was between dropout rates for vocational students and dropout rates for students in general high school programs. Mertens et al. (1982) compared the dropout rate for vocational students to the dropout rate for other high-risk students. Perlmutter (1982) formed a comparison group that matched her vocational students in aptitude and elementary school origins. Wagner (1991) examined dropout rates for vocational and other students in the special education population, a population that contains very few academic students.

Method of analysis. Reports by Catterall and Stern (1986), Coombs and Cooley (1968), Peng and Takai (1983), Perlmutter (1982), and Weber (1988) list high school dropout rates by curricular program in simple tables. Some of the tables present two-way classifications of students, in which one basis of classification is curricular program and the other is high school completion vs. non-completion, but other tables provide three-way classifications. Other reports list results from more sophisticated statistical analyses. Grasso and Shea (1979), Mertens et al. (1982), and Wagner (1991) provide regression equations that relate high school completion vs. non-completion to curricular program and other student characteristics.

Descriptive Studies

Vocational programs do not seem at first glance to encourage students to complete high school. Peng and Takai (1983) analyzed data from a nationally representative sample of approximately

30,000 students who were part of the sophomore cohort of the High School and Beyond (HSB) survey. They classified the students into curricular groups based on their sophomore-year answers to a question about curricular program. They also classified students as high school completers and dropouts on the basis of the answers on a follow-up survey conducted two years after the base survey. Vocational students appeared to have the highest dropout rate:

- Vocational curriculum – 15 percent
- General curriculum – 13 percent
- Academic curriculum – 4 percent

Weber (1988) showed, however, that the dropout picture changes with the method that is used to classify student programs. He first noted that most high school sophomores have only limited experience with vocational courses, and he suggested therefore that it was inappropriate to use sophomore-year statements to classify students into curricular tracks, as Peng and Takai had done. Weber reasoned that the answers that high school sophomores give to questions about their curricular programs might reflect their aspirations rather than their experiences. He therefore classified HSB students into academic, vocational, and general programs based on their senior-year answers on a 1982 follow-up questionnaire. For a sample of the students in the HSB database, he calculated the correlation coefficient between number of courses taken and program identification, and he found that classification by answers to the 1982 question was more consistent with actual coursetaking than was classification by answer to the 1980 question. The correlation between the 1982 answer and coursetaking was .37; between 1980 answer and coursetaking, it was .24.

What is more, Weber noted that dropout findings change when students are classified into tracks by their senior-year rather than sophomore-year answers. When track classifications were based on student self-reports provided later in high school, the vocational group had a lower dropout rate than did the general group:

- Vocational curriculum – 16 percent
- General curriculum – 21 percent
- Academic curriculum – 3 percent

Coombs and Cooley's (1968) report supports Weber's analysis. The data used by Coombs and Cooley came from Project Talent, a survey of more than 440,000 students attending public and private schools throughout the country. Project Talent researchers tested the students as 9th graders in 1960 and then sent a follow-up questionnaire to the students in 1964. Coombs and Cooley examined records of all the known dropouts in the original 9th-grade sample, and they also examined records for a random subsample of 25 percent of the male and 20 percent of the female graduates who did not continue their education beyond high school.

Coombs and Cooley presented their findings in an idiosyncratic way. They reported the percentage of dropouts who had reported in the 9th grade that they were either enrolled or expecting to enroll in general, college-preparatory, and vocational curricula, and they also reported the percentage of high school completers who had reported in the 9th grade that they expected to be in these curricular programs. In addition, they reported the percentage of the dropouts and completers who answered on the one-year follow-up questionnaire that they had been in the general, college-preparatory, and vocational programs.

It takes only a few simple computations to calculate more familiar dropout rates for vocational and other students from their figures. Dropout rates by program when programs are determined from students' 9th-grade self-categorizations are:

- Students in vocational curriculum – 21 percent
- Non-college-bound in other curricula – 15 percent

When a student's program is determined from the response on a follow-up questionnaire filled out after the student left school, dropout rates by program are:

- Students in vocational curriculum – 11 percent
- Non-college-bound in other curricula – 24 percent

Dropout rates from vocational programs thus seem to be high when curricular programs are determined from self-reports made early in high school; dropout rates seem lower when curricular programs are determined from self-reports made at the end of high school.

Catterall and Stern's (1986) study provides additional important data on the relationship of curricular program to dropout rate. These researchers also used HSB data to determine the effects of vocational programs on dropout rates, but they categorized students as vocational and nonvocational from the pattern of courses the students had taken during their freshman and sophomore years in high school (Catterall & Stern, 1986, table I, p. 79). The researchers also classified students by the students' own estimates of the likelihood that they would complete high school. I calculated from their classification table the following dropout rates for vocational participants and non-participants:

- Vocational participants – 10 percent
- Non-participants – 12 percent

In a separate analysis, Catterall and Stern (1986, table II, p. 81) classified students as vocational concentrators or non-concentrators based on the number of vocational courses they took in a single area before their junior year. They also classified students by the type of school that they attended: Some students were in schools with many dropouts, other students were in schools with few dropouts. From their classification table, I calculated the overall dropout rates for vocational concentrators and non-concentrators:

- Vocational concentrators – 5 percent
- Non-concentrators – 12 percent

The results are clear. If we identify vocational students from the courses they take, we will find a definite relation between vocational education and high school dropout. Students who pursue a vocational program are less likely than other students to drop out of high school.

Table 3.2.—Dropout rates in studies with different methods of track definition

Study	Database	Academic	General	Vocational	Nonvocational
		I. Self-report of track membership in base survey			
Peng & Takai, 1983	HSB	4%	13%	15%	11%
Coombs & Cooley, 1968	Project Talent		15%*	21%	
		II. Self-report of track membership in follow-up survey			
Weber, 1988	HSB	3%	21%	16%	11%
Coombs & Cooley, 1968	Project Talent		24%*	11%	

Table 3.2.—Dropout rates in studies with different methods of track definition—Continued

Study	Database	Academic	General	Vocational	Nonvocational
	III. Track membership determined from course selections				
Catterall & Stern, 1986, Table I	HSB			10%	12%
Catterall & Stern, 1986, Table II	HSB			5%	12%

* Classified here as general students are all nonvocational students who did not go on to college.

Table 3.2 lists results from the reports of Catterall and Stern (1986), Coombs and Cooley (1968), Peng and Takai (1983), and Weber (1988). The table shows that the conclusions we draw about dropout rates for vocational students depend on how we identify vocational students. It apparently matters a great deal whether we let vocational students identify themselves or whether we identify vocational students on the basis of the courses they take. It also matters a great deal whether we use student self-identifications made early or late in high school. Student self-categorizations made early in high school seem to reflect aspirations more than experience, and so they may not be very useful in gauging actual program effects. Student self-categorizations made later in high school are more likely to reflect the experiences that students have in vocational programs, and so they may be more useful. It appears, however, that the courses that students take provide the best indicator of their contact with vocational education. If that is so, the dropout rate for students taking vocational courses is lower than the dropout rate for other high school students.

Studies with Experimental and Statistical Controls

Although these simple descriptive analyses suggest that vocational programs help keep students in school, the analyses are not conclusive. They do not take into account other factors that influence student decisions to drop out of or to stay in school. We know that factors such as socioeconomic status, school aptitude, race, and gender play a role in dropout decisions, and we also know that vocational students and other students are not equal in these factors. If vocational students were equivalent to other students in background characteristics, would they be more or less likely to drop out? What would analyses with better experimental or statistical controls show?

Perlmutter (1982) made an effort to control for factors such as academic ability and school background through the experimental design of her study. She collected survey data from three matched groups of students on their entry into high school in New York City in 1976. The three members of each triplet differed in high school programs, but came from the same intermediate or junior high school, studied at the same level in mathematics, and had similar reading scores. One member of each triplet was admitted into a vocational high school, one member was denied admission, and one member did not apply for admission to a vocational high school. Perlmutter studied the school records of the three groups of students during the three-year period after their entry into high school.

She found a small difference in dropout rates for students in the three matched groups. During the five terms of the study, 16 of the 99 students in the vocational high school dropped out, as opposed to 18 of the 99 students who did not apply for entry and 24 of the 99 who applied and were

not admitted. The effect of vocational education on high school dropout, however, may actually be larger than these figures suggest. Perlmutter also found that many of those who did not apply for admission and many of those who were not admitted to vocational schools ultimately took vocational courses in high school. Of the 178 in the three groups who took vocational courses or attended vocational school, 21 (or 12 percent) dropped out. Of the 119 who took no vocational courses, 37 (or 31 percent) dropped out. The difference in dropout rates is a significant one.

Three investigations used regression analysis to examine effects of vocational programs on dropout rates. Grasso and Shea (1979) applied regression techniques to data collected for the National Longitudinal Surveys of Labor Market Experience (NLSLME); Mertens et al. (1982) used regression with data from the New Youth Cohort of the National Longitudinal Survey of Labor Force Behavior (NLS-Youth); and Wagner (1991) used regression with data from the National Longitudinal Transition Study of Special Education Students (NLTS). Their analyses were meant to overcome some of the problems of simple descriptive analyses. With regression analysis, it is possible to specify the effects of curricular programs on students who are comparable in relevant antecedent factors.

Grasso and Shea's (1979) regression equations predicted likelihood of high school dropout from scholastic aptitude, socioeconomic origin, area of residence, and most recent high school curriculum. Their equations therefore provide a basis for comparing the effects of vocational and other programs on dropout rates when all other influences are held constant. Grasso and Shea especially emphasize comparisons of vocational vs. general programs. They report that students in vocational and general programs are similar enough in background characteristics for comparisons of the two groups to be meaningful. Grasso and Shea report that results from comparisons of academic vs. general students are far more difficult to interpret because the two groups are so different in background characteristics.

Grasso and Shea calculated regression weights separately by gender and race and by commercial and other vocational programs. They found that, compared to a general program, a commercial program reduced dropout by 6 percent for white men, but increased dropouts by 7 percent for black men; other vocational programs reduced dropout by 1 percent for white men and by 7 percent for black men. Commercial programs reduced dropout by 9 percent for white women and by 3 percent for black women; other vocational programs reduced dropout by 8 percent for white women and by 4 percent for black women. The overall weighted effect of vocational education in Grasso and Shea's regression analysis was to reduce dropout by 5 percent.

Wagner (1988) based her regression analysis on data from the National Longitudinal Transition Study of Special Education Students (NLTS), a study of a nationally representative sample of more than 8000 students aged 13 to 21 who were in special education in the 1985–86 school year. NLTS data came from telephone interviews with parents in 1987 and also from school records and a survey of educators in the schools attended by the students. Wagner restricted her sample to students with disabilities attending regular secondary schools.

She carried out three regression analyses relating vocational education to school performance. Dependent variables in the analyses were (a) the number of days absent from school, (b) failure in a course, and (c) dropout from school. Each of the analyses included a dichotomous variable measuring whether students had been enrolled in occupationally oriented vocational education in their most recent school year. Wagner hypothesized that students who had been enrolled in vocational education would be more likely to attend school regularly, thereby having fewer days absent, and would be less likely to fail courses or to drop out of school.

She found that students taking occupationally oriented vocational education were significantly less likely to drop out of school when other factors were controlled. The likelihood of dropping out of school was 2.7 percentage points lower for vocational students. Vocational students were also about 3 percentage points less likely than others to have failed a course, and they were also absent from school less often. Wagner noted that these effects on course failure and absences had to be taken into account when interpreting her results.

Wagner pointed out that her regression equations included absenteeism and course failure as predictor variables. The 2.7 percent difference in dropout rates was for vocational and nonvocational students who were similar in absenteeism and course failure. The reduction would be greater for comparable students in vocational and other programs whose absentee and failure rates were typical for their programs. Wagner estimated that a student with a typical background would have an 8 percent chance of dropping out in a vocational education program and a 15 percent likelihood of dropping out (as well as a greater chance of failure and more absences) in a nonvocational program. Wagner concluded: "Hence, vocational education appears to offer the potential for a significant benefit to students with disabilities in terms of their school performance and school completion" (p. 24).

Mertens et al. (1982) also used regression analysis to determine whether curricular programs influence dropout rate. Their study employed data from the NLS-Youth sample, a nationally representative sample of approximately 13,000 young people who were 14 to 21 years old in 1978. Mertens and her colleagues analyzed data from 1979 and 1980 interviews as well as from high school transcripts. The researchers first divided the sample into two groups: a group with a high probability of dropping out of high school and a group with a lower probability. They used the group with the high probability of dropping out in their regression analyses. The dependent variable in the analyses was probability of dropout; independent variables came from five categories, representing both high school experiences and individual, family, contextual, and school characteristics.

Mertens and her colleagues reported that the more vocational courses students took, the less likely they were to drop out of school in a succeeding year. They found a significant relationship between dropping out and the number of courses taken in a preceding year in grades 10 and 12, but not in grade 11. The size of the coefficients, however, was very small in all years. The effect of obtaining one vocational credit in grade 9 was to reduce the probability of dropping out of grade 10 by one tenth of a percentage point. One vocational credit in grade 11 was associated with a .02 percent reduction in the probability of dropping out of grade 12.

There is a methodological problem in this analysis, however, that should not be ignored. Like Wagner, Mertens and her colleagues used both background factors and outcome variables as predictors in their regression equations. Unlike Wagner, however, Mertens and her colleagues did not estimate the effects of vocational education from background factors alone. Their regression coefficients describe the effect of curriculum on students who are identical in both background factors and such outcomes as absence from school, GPA, aspiration for further education, and so on. The regression coefficients do not therefore indicate the importance of curriculum for students who are similar in background characteristics only. They do not therefore serve as an index of the importance of curriculum.

It is worth noting that Bishop (1988) has given a different account of the findings of Mertens and her colleagues. Bishop reported that completion of one vocational education course in the 9th grade reduces the dropout rate in the 10th grade from 9 percent to 6 percent. In addition, completion of one vocational education course in the 9th, 10th, and 11th grades lowers the dropout rate in

the 12th grade from 20 percent to 14 percent. Bishop reported that the completion of a single vocational education course in grades 9 through 11 would therefore raise the high school graduation rate from 64 percent to 70 percent. Completion of two courses would raise the graduation rate to 76 percent. Bishop cites Mertens et al. (1982) as the source for his statistics, but he does not point out that his statistics are strikingly different from those given by Mertens and her colleagues. Nor does he explain how he derived his figures from the Mertens et al. (1982) report. My own conclusion is that at present neither the figures cited by Mertens and her colleagues nor those cited by Bishop can be used as estimates of program effects on dropout rates in the NLS-Youth sample. Both sets of statistics raise more questions than they answer. Grasso and Shea, Perlmutter, and Wagner provide more useful findings on vocational education and high school dropout (table 3.3).

Table 3.3.—Effect of vocational programs determined from studies with statistical or experimental controls

Study	Dropout rate for vocational students	Dropout rate for control students	Reduction due to vocational program
Grasso & Shea, 1979	8%	13%	5%
Perlmutter, 1982	16%	24%	8%
Wagner, 1991	8%	15%	7%

Conclusions

The evidence shows that vocational programs help keep students in high school. Without vocational programs, more at-risk students would drop out of school each year than currently do. With vocational education, more students complete high school. The evidence for these propositions comes from both simple descriptive classifications of students and regression analyses. Results of the simple descriptive analyses are suggestive. Results of the regression analyses are more nearly conclusive.

The most compelling of the descriptive analyses is Catterall and Stern's (1986). These investigators found a dropout rate of 10 percent for HSB students who took vocational courses before their junior year, as opposed to a dropout rate of 12 percent for those who did not take vocational courses. Making the reasonable assumptions that about 40 percent of those who did not take vocational courses were in academic programs and that the dropout rate from academic programs was about 4 percent, we can deduce that the dropout rate for nonacademic students who did not take vocational courses was 20 percent. Catterall and Stern also found a dropout rate of 5 percent for students who took one year of vocational courses in a single area before their junior year, as opposed to a dropout rate of 12 percent for those who took fewer courses in a single area. Making reasonable assumptions about the dropout rates in academic programs and about the number of the non-concentrators who were in academic programs, we are again left with the deduction that the dropout rate for nonacademic students who did not concentrate in a vocational area was about 20 percent. These findings suggest that students who are not going on to college are far more likely to complete school if they become involved in vocational programs. Although Catterall and Stern restricted their analyses to HSB students who lived in California, there is little reason to think that their results apply exclusively to one geographical region.

Although other factors might contribute to these differences in dropout rates, the most likely explanation for the low dropout rate from vocational programs is that a vocational curriculum appeals to students who are not college-bound. Lotto (1986) has pointed out that vocational courses are usually among those that students like best in high school. It seems likely therefore that high-risk students stick with vocational education because they find it interesting, relevant, and rewarding. They drop out of general programs because they find them less interesting, relevant, and rewarding.

Regression analyses firm up these conclusions. It is unfortunate indeed that no researchers have used regression analysis with the HSB data set to determine the effects of vocational programs on high school dropout and that the regression analyses of NLS-Youth data have produced unclear and confusing results. Fortunately, however, researchers have carried out adequate regression analyses of NLTS and NLS-LME data. Their studies show a difference in dropout rates of 6 percent for noncollege bound youngsters in vocational and general programs when pre-existing characteristics are controlled. Perlmutter's (1982) study suggests that in high-dropout areas such as New York City, the dropout-preventing effect of vocational education may be even greater.

A difference of 6 percent in dropout rates for noncollege bound youngsters in vocational and other programs may not seem large, but it is nonetheless an important effect. About 450,000 students in nonacademic programs drop out of high school each year. If vocational education were not an option for high school students, the number of dropouts would undoubtedly be higher. The dropout rate for youngsters currently in vocational programs might go up by 6 percent (from 8 percent to 14 percent) if these youngsters had to pursue other programs in high school. The total number of dropout from those not in college-prep programs would increase from 450,000 to 500,000. An effect of this magnitude would be too large for policy makers to ignore.

Student Achievement

Standardized tests do not measure student achievement perfectly, but they do a good enough job for people to base decisions on them. School counselors use test scores in guidance and placement; colleges use them in admissions; and the public uses them to gauge the accomplishments of schools. Most people are pleased when test scores are high, and they worry when they are low.

Vocational students do not perform as well on standardized tests as students in college programs do, and that worries some educators. Boyer (1983), for example, has concluded that vocational programs shortchange students academically. Oakes (1985) doubts that students in vocational programs get adequate preparation in basic subject areas. Lotto (1986) has concluded that vocational programs provide an inadequate preparation in the basic skills.

The Coleman report of 1966 ushered in the modern era of research on curricular tracks and student achievement (Coleman et al., 1966). Coleman's Equal Educational Opportunity Survey (EEOS) examined the relations between many individual and social factors and school learning, and it did not mince words about curricular tracks. "Tracking," Coleman wrote, "shows no relation to achievement" (p. 314). Coleman compared schools that track students with schools that do not track students, and he found no difference in test scores at the two types of schools. He concluded therefore that tracking did not make a difference in student achievement.

Coleman's focus was on differences between schools, however. He found that average test scores were very similar in schools with and without curricular tracks, but he also found that there was a great deal of variation in student achievement within schools of both types. It was this

finding that stimulated a new generation of survey research on tracking. Researchers speculated that track membership might explain some of the variation in achievement within schools. Researchers therefore began putting track membership into equations predicting the achievement of individual students within schools.

Some of the resulting studies tell us little if anything about curricular effects, but other studies are far more informative. In this chapter, I examine the variety of available studies. I first describe the studies and look at some of the differences among them. I then turn to the study findings and their implications.

Studies

The studies I review in this chapter came from two sources: (1) a computerized search of the data base of the Educational Resources Information Clearinghouse (ERIC); and (2) studies referred to in reviews located through the ERIC search. I first searched the full text of citations and abstracts in the ERIC data base from the years 1982 through September 1993 for the terms *secondary education, vocational education, and academic achievement.* I located a total of 74 abstracts that contained the three terms. Relatively few of the documents, however, contained relevant quantitative findings. Reviews by Weber et al. (1982) and by Mertens et al. (1980) turned out to be very useful for finding earlier studies.

Through direct database searching and branching, I located 10 studies with relevant findings (table 4.1). The studies have some things in common. Each covers either a national or state-wide population of young people. Each reports on student achievement as measured by broad tests administered near the end of high school, and each contains a quantitative description of average performance and variation in performance in vocational and nonvocational programs. The studies were not uniform in design, however. They differed in (a) method for identifying vocational students; (b) the groups to which vocational students are compared; and (c) method of analysis.

Identification of vocational students. Alexander et al. (1978) and Echternacht (1975) used student transcripts to identify the curricular programs of students. All other researchers relied on student self-categorizations. Evans and Galloway (1973), Hilton (1971), and Jencks and Brown (1975) used self-categorizations that students made at the beginning of secondary school; Alexander and Cook (1982) and Alexander and McDill (1976) relied on categorizations that students made at the end of high school. Gamoran (1987) and Vanfossen, Jones, and Spade (1987) used self-categorizations made both early and late in high school to place students into tracks. Although some of their analyses involve students who switched tracks between grades 10 and 12, they estimate the size of tracking effects from the test scores of students who stayed in the same track over the period of the study: track-stayers (about 60 percent of the sample) rather than track movers.

Comparison groups. The most valuable studies for our purposes are those that report test scores separately for academic, general, and vocational groups. Echternacht (1975), Evans and Galloway (1973), Gamoran (1987), Hilton (1971), and Vanfossen et al. (1987) conducted studies of this sort. Other researchers reported on academic versus nonacademic groups and did not distinguish between students in vocational and general programs (i.e., Alexander et al., 1978; Alexander & Cook, 1982; Alexander & McDill, 1976; Jencks & Brown, 1975). Trent's (1982) study compares test scores of vocational and nonvocational students and does not distinguish between those in academic and general tracks.

Table 4.1.—Description of 10 studies on track differences in student achievement

Study	Data collection	Data analysis
Alexander & Cook, 1982	Data from the Academic Growth Study (see Hilton, 1971). This study used a subsample of data from approximately 1900 students in 8 comprehensive high schools in 3 large districts across the U.S. Survey data were collected in fall 1965 when students were in grade 9, in fall 1967 when they were in grade 11, and in spring 1969 when they were in grade 12.	Regression analyses. Dependent variables were PSAT-M, PSAT-V, English, and history scores. Track (academic vs. nonacademic) coded from student survey responses in grade 11. Other predictor variables measured background, pre-test achievement, & course work in program.
Alexander, Cook, & McDill, 1978	Like Alexander & Cook (1982), this study used data from the Academic Growth Study. Sample of approximately 1600 AGS students used in this analysis.	Regression analysis. Dependent variables were PSAT-M and PSAT-V. Track (academic vs. nonacademic) coded from transcripts and student survey answers in grade 11. Other predictor variables measured student background factors and 9th-grade achievement.
Alexander & McDill, 1976	Johns Hopkins survey. Sample used in analyses were approximately 3,700 students in 18 publiccoeducational high schools. Survey data collected in 1964 and 965 when students were seniors.	Regression analyses. Dependent variable was math achievement. Curricular track (academic vs. nonacademic) coded from student survey answers. Other predictor variables measured student background factors and student ability.
Echternacht, 1975	Class of 1972 survey tested approximately 18,000 high school seniors from more than 1,000 schools in 1972.	Description of test scores by track. Track determined from high school records. Tests covered vocabulary, reading, picture-number association, mathematics, mosaic comparisons, and letter groups.

Table 4.1—Description of 10 studies on track differences in student achievement—Continued

Study	Data collection	Data analysis
Evans & Galloway, 1973	Project Talent surveyed 440,000 students attending public & private high schools. Students tested as 9th graders in 1960 and again in a 1964 follow-up.	Description of test scores by track. Track determined from student responses in 9th grade.
Gamoran, 1987	High School and Beyond survey of a national sample of approximately 13,000 public high school students. Survey data collected from students when they were sophomores in 1980 and seniors in 1982. Survey and transcript data also collected from schools.	Regression analysis. Dependent variables were test scores in math, science, reading, vocabulary, writing, and civics. Track determined from student responses in grades 10 and 12. Other predictor variables measured student background, pre-test achievement, and student course work.
Hilton, 1971	The Academic Growth Study tested approximately 32,000 students in 27 high schools and their feeder elementary schools. Initial testing was in 1961. Original sample included grades 5, 7, 9, and 11. Sample used in analyses reported here consisted of approximately 6,000 AGS students in graduating class of 1969.	Description of test scores by track. Track determined by student responses in grade 7. Test scores were on the Sequential Tests of Educational Progress (STEP): math, science, social science, writing, listening, and reading.
Jencks & Brown, 1975	Like Evans & Galloway (1973), Jencks and Brown used Project Talent data. They restricted their analysis to approximately 5,000 Project Talent students from 91 predominantly white public high schools.	Regression analysis. Dependent variables were test scores in vocabulary, social studies, reading, abstract reasoning, arithmetic reasoning, and arithmetic computation. Track (academic vs. nonacademic) determined by student responses in grade 9. Other predictor variables measured background factors and pre-test achievement.

Table 4.1.—Description of 10 studies on track differences in student achievement—Continued

Study	Data collection	Data analysis
Trent, 1981	Ohio state study of students who were 12th graders in 55 randomly selected districts in Ohio. Achievement and ability tests given in November 1980 and achievement tests given again in April and May 1981.	Description of test scores by track. Test scores were from the California Achievement Tests (reading comprehension, total language, and total math) and the Otis Lennon School Ability Test.
Vanfossen, Jones, & Spade, 1987	High School and Beyond survey collected data from a national sample of approximately 30,000 public high school students. Survey data collected from students when they were sophomores in 1980 and seniors in 1982. Survey and transcript data also collected from schools. This analysis utilized data from approximately 6,500 students from HSB survey who stayed in same tracks between sophomore and senior year.	Regression analysis. Depen dent variable was a composite of scores on tests of vocabulary, reading, and mathematics. Track determined from student responses in grades 10 and 12. Other predictor variables measured student background, 10th-grade social-psychological characteristics, and 10th-grade academic characteristics.

Method of analysis. Echternacht (1975), Evans and Galloway (1973), Hilton (1971), and Trent (1982) carried out simple descriptive analyses of test scores. Alexander and McDill (1976) carried out a regression analysis using cross-sectional data. Alexander and Cook (1982), Alexander et al. (1978), Gamoran (1987), Jencks and Brown (1975), and Vanfossen et al. (1987) carried out regression analyses using longitudinal data. The descriptive analyses present a simple statistical description of test performance by group. The goal of the regression analyses is to determine whether apparent differences among groups are actually program effects.

I discuss these differences in research design as I present the findings from the various analyses. It is necessary now to note only that all the results that I present are calculated from statistics presented in the reports. I used standard statistical equations to translate results from each study into a common metric of standard deviation units. I also used normal curve areas to convert the resulting z-scores into percentile scores.

Findings

I have divided the studies of curricular effects on student achievement into four main types. The first type of study reports on the performance of academic, general, and vocational students in terms of national norms. The second type of study applies regression analysis to cross-sectional data in order to compare the performance of academic, general, and vocational students who are

similar at the end of high school in measured aptitude and in other characteristics. The third type of study applies regression analysis to longitudinal data in order to compare the end-of-school performance of academic, general, and vocational students who were similar in aptitude and background at the beginning of high school. A fourth type of study also uses regression analysis and longitudinal data, but studies of this type compare performance of students in different curricular programs who are similar not only in background characteristics, but who also take a similar number of advanced courses in core high school subjects.

Comparisons with national norms. Weber et al. (1982) wrote an authoritative review of studies examining performance of vocational students on standardized tests. They concluded that the scores of vocational students on standardized tests fall about 0.5 standard deviations below national norms. Students in vocational programs thus fall between the 35th and 40th percentile on standardized tests. Weber and his colleagues also noted that this performance level was typical for vocational students both at the beginning and at the end of the programs.

Table 4.2 is based on results in studies cited by Weber et al. (1982). It is obvious that at the end of high school there is an achievement gap between students in academic and nonacademic programs. Students completing vocational programs score on the average 0.43 standard deviations below the national norms; students completing general programs score 0.42 standard deviations below the norm; and students completing academic programs score 0.57 standard deviations above the norm. Test scores of vocational and general students fall at the 34th percentile; test scores of students completing academic programs fall at the 71st percentile. It is also obvious that there is an achievement gap at the start of high school between students who elect different programs. The percentile score of each group at the beginning of high school is nearly the same as the group's percentile score at the end of high school.

The similarity suggests that students in the three curricular groups grow academically at the same rate. This consistency in rate of growth was an important finding of the Academic Growth Study (Hilton, 1971). Students in the Academic Growth Study took standard achievement tests in grades 5, 7, 9, and 11. Figure 4.1 shows the relationship over time between test scores in mathematics and curricular group membership as determined by self-report in grade 11. The pattern of results is the same for other tests used in the Academic Growth Study. Two points are worth noting about the figure. First, the lines for the academic, general, and vocational groups are nearly parallel during the junior and senior high school years. This means that none of the groups falls behind or gets ahead during the period in which students were taking vocational, academic, and general courses. Second, the lines for general and vocational groups are nearly indistinguishable from the earliest points of measurement. This similarity in pretest scores suggests that students in general programs may be a good comparison group for students in vocational programs. Comparison of academic and vocational groups, on the other hand, are harder to justify on methodological grounds (Grasso & Shea, 1979; Slavin, 1990a; Woods & Haney, 1981).

Although academic, general, and vocational groups show the same growth patterns on academic tests, it is worth noting that the groups do not show parallel growth in all areas of knowledge. Hilton (1971) has provided graphic evidence that rates of growth are very different for academic and vocational students on a test of knowledge of industrial arts (Figure 4.2). Academic and general students hardly increase at all in their knowledge of industrial arts during the middle and high school years. Vocational students, on the other hand, learn a significant amount about industrial arts during the high school years.

Table 4.2.—Average achievement scores by program, expressed as national percentiles

	Academic		General		Vocational	
Study	Early	Late	Early	Late	Early	Late
Echternacht, 1975		0.45 (67)		-0.33 (37)		-0.36 (36)
Evans & Galloway, 1973	0.69 (76)	0.80(79)	-0.26 (40)	-0.31 (38)	-0.47(32)	-0.52 (30)
Hilton, 1971	0.50 (69)	0.47 (68)	-0.61 (27)	-0.63 (26)	-0.55 (29)	-0.60 (28)
Trent, 1981						-0.25 (40)
Overall		0.57 (71)		-0.42 (34)		-0.43 (34)

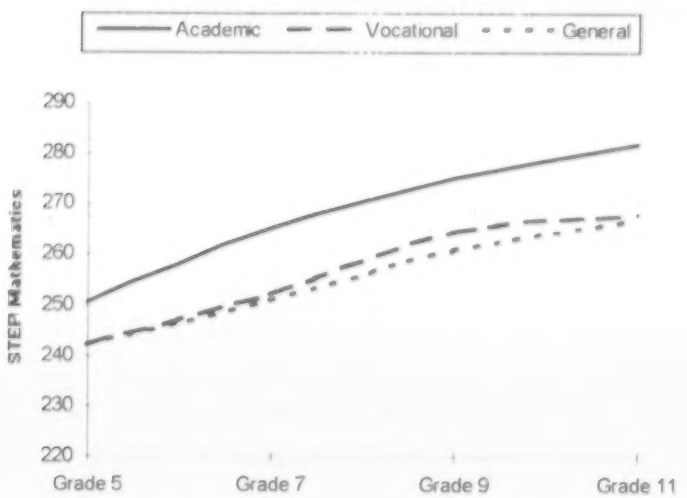

Figure 4.1. Mean Standardized Scores on STEP Mathematics by Year and Curriculum. (Based on Hilton, 1971).

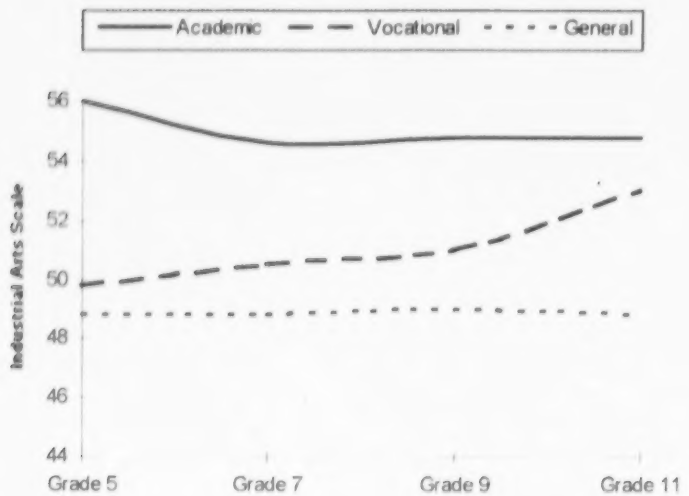

Figure 4.2. Mean Standardized Scores on Industrial Arts Scale by Year and Curriculum. (Based on Hilton, 1971).

Table 4.3.—Regression estimates of standard and percentile scores on overall tests of achievement, by curricular program and study

Study	Academic	General	Vocational	Nonvocational	Nonacademic
I. Cross-sectional data with statistical control for background factors and aptitude					
Alexander & McDill, 1976	0.40 (66)				–0.40 (34)
II. Longitudinal data with statistical control for background factors and pretest scores					
Alexander, McDill, & McCook, 1978	0.10 (54)				–0.15 (44)
Alexander & Cook, 1982, eq. 2	0.05 (52)				–0.12 (45)
Gamoran, 1987, eq. 5a	0.10 (54)	–0.06 (48)	–0.13 (45)	0.03 (51)	–0.08 (47)
Jencks & Brown,1975	0.03 (51)				–0.03 (49)
Vanfossen, Jones, & Spade, 1987, eq. 8	0.15 (56)	–0.08 (47)	–0.20 (42)	0.04 (52)	–0.12 (45)

Table 4.3.—Regression estimates of standard and percentile scores on overall tests of achievement, by curricular program and study—Continued

Study	Academic	General	Vocational	Nonvocational	Nonacademic
III. Longitudinal data with statistical control for background, pretest scores, and course work					
Alexander & Cook, 1982, eq. 8	0.01 (50)				–0.03 (49)
Gamoran, 1987, eq. 5c	0.06 (52)	–0.02 (49)	–0.10 (46)	0.02 (51)	–0.05 (48)

NOTE: Results are in z-score form; percentile equivalents are in parentheses.

Regression analyses with cross-sectional data. The evidence from simple descriptive studies is far from conclusive, however. To draw firmer conclusions, we need studies in which researchers measure background, curricular, and outcome variables on the same students. We also need statistical analyses in which researchers are able to make separate estimates of the importance of these factors. One approach that yields such estimates is regression analysis. Table 4.3 presents the results of such analyses along with the results of the simple descriptive analyses that I have already reviewed.

Alexander and McDill (1976) used regression analysis with cross-sectional data to estimate the importance of curriculum when background factors are held constant. Their data came from a survey conducted by Johns Hopkins University researchers in 1964 and 1965. The survey covered 3,700 seniors in 18 public high schools. Alexander and McDill assumed that a number of factors influenced achievement, including background factors (e.g., socioeconomic status, number of siblings, and gender); academic aptitude; peer characteristics (e.g., the academic aptitude, socioeconomic status, and educational expectations of the student's friends); and differences in the schools that the students attended. Alexander and McDill's goal was to find out whether curricular track had an effect over and above the effect of such factors.

They found that their entire set of variables accounted for 48 percent of the variance in mathematics achievement. Academic ability was a major direct determinant of achievement, but track membership was almost as important a factor. Students in the academic track scored 0.80 standard deviation units higher than students of comparable ability and background in nonacademic tracks. The effect is a large one by almost any standard. The result suggests that moving a typical student from a nonacademic to an academic track would raise the student's mathematics test score by 0.80 standard deviations, or from the 34th percentile to the 66th percentile. In other words, nonacademic students would perform at a much higher level if switched to an academic track.

Later and better analyses of survey and test data have not supported the results of Alexander and McDill's study, however. The basic problem with Alexander and McDill's analysis is its use of aptitude data collected concurrently with the outcome data. To measure scholastic aptitude, Alexander and McDill used a 15-item multiple-choice test measuring ability to find logical relationships in patterns of diagrams. The test may have been the best one available to the investigators, but it was not good enough for this kind of analysis. For one thing, the reliability of the test was between .60 and .65, or not very high. For another, the academic aptitude measure correlated about .50 with the outcome measure of mathematics achievement. Subsequent studies have shown that the reliability and validity of this measure are too low for work on track effects.

More recent longitudinal studies have used pretest scores to predict achievement outcomes, and the investigators who have used such scores have reported much larger correlations with outcome measures. Jencks and Brown (1975) and Gamoran (1987), for example, reported correlations in the .80s between measures of achievement made at the beginning of high school and those made during later high school years. The moral is clear. Aptitude tests such as those administered in the senior year in Alexander and McDill's study do not adequately reflect the capacities that students have when they enter high school.

It is also difficult to defend logically the use of end-of-program measures of ability as control variables in studies of tracking. A basic problem is that both aptitude and achievement scores change with education. Aptitude scores on tests administered at the end of high school may therefore make good outcome variables, but they cannot serve as proxies for scores on aptitude tests administered at the beginning of high school. Studies that use end-of-school aptitude scores as predictor variables are likely to produce misleading results.

Regression analyses with longitudinal data. Longitudinal designs overcome this basic limitation of cross-sectional studies, and most investigators have therefore used longitudinal data in their regression analyses (table 4.3). Jencks and Brown (1975) carried out one of the first of these longitudinal analyses. They examined data from 91 predominantly white comprehensive high schools throughout the United States that had tested their students for Project Talent in the 9th grade and then had retested them in the 12th grade. Some of the students reported in the 9th grade that they were in academic programs, and others identified themselves as being in nonacademic programs. Jencks and Brown showed that academic and nonacademic students who were initially similar on pretests and in background would also be similar on outcome tests at the end of high school. The academic students averaged only 0.06 standard deviation units higher on achievement tests than did comparable nonacademic students. The effect is a trivial one by almost any standard, and Jencks and Brown concluded therefore that curricular tracks do not have much effect on students' test scores.

Alexander, Cook, and McDill (1978) examined the influence of track placement on scores in Educational Testing Services' Academic Growth Study, and they reported more substantial effects. They classified students into college and noncollege tracks based on their reported course work and self-reported curricular track. Predictor variables in their regression equations werein addition to curricular programsocioeconomic background, gender, race, academic aptitude, and educational plans. Dependent variables were verbal and quantitative scores on the Scholastic Aptitude Test (SAT). Alexander and his colleagues found that students in the academic track scored about 16 points higher than similar nonacademic students on the SAT verbal (about 0.14 standard deviations) and 47 points higher on the SAT quantitative (about 0.36 standard deviations). Differences between academic and nonacademic students therefore averaged 0.25 standard deviations.

Alexander and Cook (1982) reanalyzed the data from the Academic Growth Study, using student self-report data alone to identify a student's curricular track. Predictor variables were similar to those used by Alexander et al. (1978), and dependent variables were test scores in history and English and PSAT-M and PSAT-V scores. Alexander and Cook carried out several regression analyses, and one of these examined effects of curricular track with background and aptitude factors controlled. Alexander and Cook's results were very similar to Alexander et al.'s (1978) results. They found that on the average test, the academic track raised performance by 0.17 standard deviations.

Both Gamoran (1987) and Vanfossen, Jones, and Spade (1987) used HSB data in analyses similar to those of Jencks and Brown (1975) and Alexander et al. (1978). The HSB data set came from a survey of approximately 30,000 high school sophomores and seniors surveyed initially in 1980 and again in a 1982 follow-up. Both Gamoran and Vanfossen and her colleagues estimated effects of curricular tracking on students who stayed in the same high school tracks for the two-year period between sophomore and senior year in high school. Both of the research studies were based on the assumption that factors other than curricular program influenced student achievement: socioeconomic background, race, sex, and educational expectations in the 8th grade; 10th-grade social-psychological variables (friends' plans to go to college, educational expectations) and 10th-grade academic characteristics (grades so far, courses completed in the subject area of the dependent variable). The researchers therefore formed regression equations that allowed them to specify the effects of track membership with these pre-existing characteristics held constant.

Vanfossen et al. (1987) analyzed scores on a composite achievement measure based on tests of vocabulary, reading, and math. Their regression equation predicts that a student who is average on all background factors (z-scores = 0.00) would score 0.15 standard deviations above the population mean on achievement tests if placed in the academic track, 0.08 standard deviations below if placed in the general track, and 0.20 standard deviations below the mean if placed in the vocational track. This implies that on a nationally normed test the student would score at the 56th percentile if placed in the academic track, at the 47th percentile if placed in the general track, and at the 42nd percentile if placed in the vocational track.

Gamoran (1987) analyzed scores on six achievement measures (mathematics, science, reading, vocabulary, writing, and civics). His results were similar to the findings of Vanfossen and her colleagues. According to Gamoran's regression equation, a student who was average on all background factors would score 0.10 standard deviations above the population mean on achievement tests if placed in the academic track, 0.06 standard deviations below if placed in the general track, and 0.13 standard deviations below the mean if placed in the vocational track. On a nationally normed test the student would score at the 54th percentile if placed in the academic track, at the 48th percentile if placed in the general track, and at the 45th percentile if placed in the vocational track.

Regression analyses with course work as a predictor variable. Why do students learn less in the vocational track? There are two factors to consider. First, students in vocational programs are more likely to be in the lower level of core courses that all students take. That is, they are unlikely to be in the elite sections of stratified core courses. Second, students in the vocational track take fewer advanced courses. Compared to academic students, for example, they are less likely to take advanced math courses, advanced science courses, foreign languages, and so on.

Alexander and Cook (1982) and Gamoran (1987) carried out further regression analyses to determine whether the achievement differential for vocational and academic students could be explained by the second factor, the number of advanced courses that students take in core areas (table 4.3). They developed regression equations in which they were able to hold constant students' prior background and subsequent course work while investigating the effects of curricular track alone. The analyses complemented Alexander and Cook's and Gamoran's analyses in which only background variables were held constant.

Alexander and Cook (1982) used data from the Academic Growth Study in their analysis. They found that effects of curricular track were reduced when students were compared who took the same number of advanced courses in an area. In fact, academic, general, and vocational students

all performed at the same level when both background factors and advanced courses were held constant. Gamoran (1987) used the HSB data set in his analysis. Gamoran's analysis covered six different outcome tests. He found that on the average achievement test, academic students scored 0.08 standard deviation units higher than comparable general students who had taken the same number of advanced courses (table 4.3). General students scored 0.08 higher than comparable vocational students who had taken the same number of advanced courses.

These analyses suggest that curricular programs produce most, but not quite all of their effects by prescribing different numbers of advanced courses for students. Nonacademic students usually take fewer advanced courses in subjects like mathematics and this affects their performance on mathematics tests. If vocational students elected as many advanced courses in mathematics as academic students did, the gap between vocational and academic students would be narrowed.

Conclusions

Test scores of high school students completing academic and vocational programs are clearly different. Academic students usually score at the 71st percentile on standardized achievement tests given at the end of high school (or about 0.56 standard deviations above the mean); vocational students usually score at the 34th percentile (or about 0.41 standard deviations below the mean). The achievement gap at high school graduation is therefore large. The question is, What causes it?

Regression analyses suggest that the most important cause of the achievement gap is student self-selection into academic and vocational programs. If the same students enrolled in the two types of programs, graduates of the two programs would differ very little in test scores at the end of high school. A second factor contributing to the achievement gap is the different number of advanced courses in core subjects taken by academic and vocational students. Academic students take more of these advanced courses. If vocational students were as academically strong as college-prep students at the beginning of high school *and* they took as many advanced courses in core areas as college-prep students do, their test scores would be nearly indistinguishable from those of college-prep students at the end of high school.

It is possible to quantify these results. The difference in test scores of academic and vocational students on standardized tests at the end of high school is equal to about 1.0 standard deviation. Regression analyses suggest that the gap would be about 0.2 standard deviations if similar students enrolled in academic and vocational programs. Thus, 80 percent of the difference in test scores of academic and vocational students at the end of high school appears to be due to the difference in aptitude of the students who enter the programs. In addition, regression analyses suggest that 10 percent of the achievement gap is due to the different number of advanced courses in core subjects taken by academic and vocational students. If vocational students were similar to academic students in aptitude and took the same number of advanced courses in core subjects, the achievement gap between academic and vocational students would be no more than 0.1 standard deviations. The remaining 10 percent of the gap is due to other curricular and program factors.

Regression analyses, therefore, suggest that moving a student from a vocational to an academic program would raise a students test scores on academic achievement tests. The increase in scores might be as much as 0.2 standard deviations (if the student took a heavy load of advanced courses in mathematics, English, and so on) or as little as 0.1 standard deviations (if the student avoided advanced courses). Two questions naturally arise about these regression results. First, how important are these differences? Second, how trustworthy are the analyses that produced the results.

On the question of importance of these differences, two points are worth noting. First, an increase in test scores of 0.1 to 0.2 standard deviations is a trivial to small effect. Cohen (1977) has reviewed the educational and psychological literature on effect sizes. He concluded that an effect of 0.8 standard deviations is large, an effect of 0.5 standard deviations is moderate in size, and an effect of 0.2 standard deviations is small. Moving a student from a vocational to an academic program will have at best a small effect on the students test scores in academic subjects.

In addition, the difference is found on standardized tests in academic subjects and such tests do not measure all the things that students learn in high school. Standardized tests give a lot of weight to skills that are useful for survival in college; they give less weight to skills and knowledge that are useful in jobs and careers. Although academic and vocational students appear to grow at the same rate in academic knowledge, they apparently grow at different rates in job knowledge. Hilton (1971), for example, has provided graphic evidence that vocational students acquire industrial arts knowledge at a quicker rate than academic students do. In addition, specific vocational programs may prepare students very well in specific academic areas. In fact, some vocational programs may outdo academic programs in specific areas. Ramey (1990), for example, has reported that business students increase their verbal skills at a faster rate in business programs than they would in an academic or general program.

A more critical question is whether regression comparisons of vocational and academic students are trustworthy. Slavin (1990a) has argued forcefully that they are not. He believes that such comparisons are untrustworthy because academic and vocational students differ too much in aptitude and in too many other ways at the start of high school. For regression results to be trustworthy in such situations, measures of relevant initial characteristics would have to be both complete and completely reliable. According to Slavin, they never are. It is difficult to know therefore what conclusions to draw from regression comparisons of academic and vocational students. Even if academic and vocational tracks had identical results on students, Slavin has noted, the studies comparing the achievement of academic and vocational students would still show higher achievement for the academic track.

We are on sounder ground with regression comparisons of students in vocational and general tracks. The students in these tracks do not differ greatly in aptitude initially, and regression problems are therefore less severe in comparisons of students in the two tracks. The regression analyses suggest, however, that general and vocational programs have roughly the same effects on student achievement. General and vocational students score at nearly identical levels on standardized achievement tests given both at the beginning and at the end of high school. General students score on the average at the 34th percentile (or about 0.41 standard deviations below the mean); vocational students score on the average at the 32nd percentile (or about 0.47 standard deviations below the mean). Regression analyses suggest that program effects are trivial. If the same students enrolled in general and vocational programs, their test scores would differ by less than 0.1 standard deviation, a trivial amount, at the end of high school.

My overall conclusion therefore is that academic and vocational programs may differ slightly in how well they prepare students in the broad academic skills needed in modern society. Academic programs may provide slightly better academic preparation. Requiring vocational students to pursue a college-preparatory curriculum might raise their sores on tests of academic skills by 0.2 standard deviations, but we cannot be sure. This estimate may be inflated by two methodological artifacts: imperfect reliability in the measurement of predictor variables and incomplete measurement of factors influencing student achievement. General and vocational programs, on the other

hand, seem to have equivalent effects on student achievement. Moving a student from the vocational track to the general track would have no measurable effect on the students overall achievement level.

Educational Attainment

Researchers give educational attainment a central place in models of status mobility in American society. In Blau and Duncan's (1967) classic model, for example, parental background contributes little to status when educational attainment is controlled. The effect of educational attainment on status is direct, whereas the effect of parental background is indirect. The model suggests that high-status families maintain their position by encouraging the educational attainment of their children. The children of lower status families ascend the ladder of success via educational attainment.

Vocational education usually means training for occupations requiring less than a college degree, and so the educational attainment of most vocational graduates is limited. Heyns (1974) noted that 85 percent of those in academic programs but only 15 percent of the students in other programs go on to college. This has been a cause of real concern for some educators. Compared to academic programs, vocational and other nonacademic programs seem to limit young people's opportunities for social advancement.

Although researchers agree that vocational and academic students differ in educational attainment, they disagree on what lies behind this difference. Some researchers believe that tracks shape students and that tracking is responsible for the attainment gap between academic and vocational students. Others argue that the attainment gap is the inevitable result of student self-selection into academic and vocational programs. They believe that students who select academic and vocational programs differ so much in aptitude and aspirations at the start of high school that they would differ in their attainments no matter what they experienced in high school.

In this chapter, I focus on curricular effects on educational attainment. The studies that provide the evidence on this topic are varied, and I first describe some of their features. I then turn my attention to study findings. Finally, I discuss implications of the study results.

Studies

I located studies of educational attainment in two places. My first source was a computerized search of the library data base maintained by the Educational Resources Information Clearinghouse (ERIC). I searched the full text of ERIC citations and abstracts from the years 1982 through September 1993 for the terms *secondary education*, *vocational education*, and *educational attainment*. I located 15 documents that included these terms in citations or abstracts. I reviewed all the documents either in full or in abstract form. My second source was the reference lists in the documents located in the ERIC search. I used these reference lists to find other relevant documents.

Through direct database searching and branching, I located a total of 8 usable studies (table 5.1). Each of the studies analyzed outcomes on a quantitative or quasi-quantitative scale of educational attainment, and almost all of the studies used data collected longitudinally from national samples of young people. Conroy and Diamond's (1976) and Hauser, Sewell, and Alwin's (1976) studies were the exceptions to the rule. Conroy and Diamond's study used cross-sectional data collected from a state-wide sample of young people in Massachusetts; the study by Hauser and his

colleagues used longitudinal data collected from a representative sample of young people in the state of Wisconsin. The studies are far from uniform in all respects, however. They differ in (a) method for identifying vocational students; (b) definition of postsecondary education; (c) use of dichotomous vs. continuous measures of postsecondary enrollment; (d) length of follow-up period; and (e) handling of educational aspirations in regression analyses. Each of these characteristics can affect study outcomes.

Identification of vocational students. Campbell and Basinger (1985), Creech et al. (1977) and Hauser et al. (1976) used school records to classify students as vocational or nonvocational, but other researchers used student self-reports to make the classification. Jencks and Brown (1975) relied on self-reports from early in high school. Conroy and Diamond (1976), Grasso and Shea (1979), and Hilton (1971) used self-reports made at the end of high school or in response to questions asked in follow-up interviews. Vanfossen et al. (1987) incorporated both sets of self-reports into their classification of students as *track stayers* and *track movers*. Track stayers were students who reported being in the same curricular programs in both their sophomore and senior years in high school; track movers were those who classified themselves differently in the two years. Vanfossen and her colleagues restricted their analyses to track stayers, about 60 percent of the total sample.

Definition of postsecondary education. Most of the studies counted enrollment in a college or technical or vocational institution as postsecondary education (e.g., Campbell & Basinger, 1985; Conroy & Diamond, 1976; Creech et al., 1977; Hauser et al., 1976; Jencks & Brown, 1975; Vanfossen et al., 1987). Hilton (1971), however, measured educational attainment as number of years of education in two- and four-year colleges only. Grasso and Shea (1979) used different approaches in different analyses. For some of their analyses, they defined attainment as years of college or years of technical and vocational training. For other analyses, they defined educational attainment as years of college alone.

Table 5.1.—Description of 8 studies of track differences in educational attainment

Study	Data collection	Data analysis
Campbell & Basinger, 1985	NLS Youth surveyed approximately 13,000 persons aged 14 to 21 in January 1979 and conducted follow-ups through 1982. Classof 1972 survey tested 19,000 high school seniors in 1972 and conducted follow-ups through 1980.	Descriptive statistics and regression analysis. Dependent variable: percentage enrolled in college or postsecondary training. Curricular programs identified from records. Other predictor variables: family background, aspirations, and test scores.

Table 5.1—Description of 8 studies of track differences in educational attainment—Continued

Study	Data collection	Data analysis
Conroy & Diamond, 1976	Massachusetts Transition project surveyed approximately 8,000 students in classes of 1969 and 1973 by mail questionnaire during summer and fall of 1975.	Descriptive analysis. Program (vocational vs. nonvocational) apparently determined from questionnaire response. Dependent variable: percentage enrolled in postsecondary schools.
Creech et al., 1977	Class of 1972 survey tested approximately 18,000 high school seniors from more than 1,000 schools nationwide in 1972. Follow-up attainment data collected 18 months after graduation.	Descriptive statistics and regression analysis. Dependent variables: percentage enrolled in college and in any postsecondary institution. Curricular program determined from high school records. Other predictor variables: ability, aspirations, curriculum, family aspirations, family education, and years in community.
Grasso & Shea, 1979	National Longitudinal Survey of Labor Market Experience (NLS–LME) interviewed in fall 1966 a national sample of 5,000 young men aged 14 to 24, and interviewed in 1968 a sample of 5,000 young women. Analysis of educational attainment data restricted to students who were in grades 10–12 during the base years and who were contacted in 1972–73 follow-up.	Regression analyses. Dependent variables: percentage with one or more years of postsecondary education or training, highest year completed in high school or college. Curricular program determined from self-report in follow-up surveys. Other predictor variables: aptitude, socioeconomic background, residence, and (in some analyses) educational aspirations.

Table 5.1—Description of 8 studies of track differences in educational attainment—Continued

Study	Data collection	Data analysis
Hauser, Sewell, & Alwin, 1976	Panel study of Wisconsin youth who graduated from high school in spring 1957 and whose parents were surveyed in a 1964 follow-up. Sample used in analysis consisted of approximately 3,300 students.	Regression analysis. Dependent variable was highest year of school or vocational training completed. High school program coded from records. Other predictor variables were gender, socioeconomic background, and academic aptitude.
Hilton, 1971	Academic Growth Study tested approximately 32,000 students in 27 high schools (and their feeder elementary schools) approximately representative of American schools. Students in grades 5, 7, 9, and 11 were initially tested in 1961. Follow-up data collected from approximately 6,000 students one year after high school graduation in 1967 and from approximately 7,000 students three years after graduation in 1965.	Basic descriptive analysis and path analysis. For descriptive analysis, programs were academic, general, and vocational, and dependent variable was percentage enrolled in college. For path analyses, programs were academic and nonacademic, and dependent variable was status on a five- or ten-category ordinal scale reflecting years of college completed. Curricular program determined from grade 11 self-report. Other variables in path analyses reflected socioeconomic status and academic aptitude.
Jencks & Brown, 1975	Project Talent surveyed 440,000 students attending public and private high schools. Approximately 5,000 of these students were included in this analysis. The students were from 91 predominantly white public high schools. Test and survey data collected when students were 9th graders in spring 1960 and again when they were 12th graders in spring 1963. Attainment data from five-year follow-up questionnaire.	Regression analysis. Dependent variable was highest year of school or training completed. Program (academic vs. nonacademic) determined by student responses in grade 9. Other predictor variables were gender, race, socioeconomic background, number of siblings, composite achievement on pretests, grades, and educational plans.

Table 5.1—Description of 8 studies of track differences in educational attainment—Continued

Study	Data collection	Data analysis
Vanfossen, Jones, & Spade, 1987	High School and Beyond survey collected data from a national sample of approximately 30,000 public high school students. Survey data collected from students when they were sophomores in 1980 and seniors in 1982. Follow-up data collected in 1984. Survey and transcript data also collected from schools. This analysis utilized data from approximately 6,500 students from HSB survey who stayed in same tracks between sophomore and senior year.	Regression analysis. Dependent variable was a five-category variable that reflected years of schooling or vocational training. Program (academic vs. general vs. vocational) determined by student responses in grades 10 and 12. Other predictor variables measured background factors, educational aspirations, scores on pretest, and high school course work.

Dichotomous vs. continuous criteria of educational attainment. Some researchers (e.g., Campbell & Basinger, 1985; Conroy & Diamond, 1970; Creech et al., 1977) used a dichotomous measure of educational attainment. They classified students into the two categories of (a) those who continued their education beyond high school and (b) those who did not. Other researchers used a continuous measure of attainment. Jencks and Brown (1975), for example, used total years of schooling as their dependent measure. Vanfossen et al. (1987) used a five-category variable: (a) non-student; (b) part- or full-time student at other institution; (c) part- or full-time student at a two-year college; (d) part- or full-time student at a public or four-year college; (e) part- or full-time student at a private four-year college. Hilton (1971) used a similar five-category variable in some analyses, but he used a ten-category variable for other analyses. Grasso and Shea (1979) used different approaches in different analyses. They used a dichotomous dependent variable in some analyses; for other analyses their dependent variables was number of years of schooling.

Length of follow-up period. Creech et al. (1977) determined educational attainment from follow-up data collected about 18 months after students completed (or were scheduled to complete) high school. Vanfossen et al. (1987) analyzed data from a two-year follow-up. Hilton's (1971) data came from one- and three-year follow-ups. Campbell and Basinger (1985) collected follow-up data one through seven years after students left high school. Conroy and Diamond (1976), Grasso and Shea (1979), Hauser et al. (1976), and Jencks and Brown (1975) determined educational attainment five or more years after students were scheduled to graduate from high school.

Educational aspirations. Campbell and Basinger (1985), Creech et al. (1977), Jencks and Brown (1975), and Vanfossen et al. (1987) included variables in their regression equations that represented the high school educational aspirations of the students. Their regression equations are therefore designed to provide estimates of the importance of curricular programs for students with

the same educational aspirations. Hauser et al. (1976) and Hilton (1975) did not include variables representing educational aspirations in their regression equations. Their equations provide estimates of the importance of curricular programs for students who are similar in aptitude and background but who differ in educational aspirations at the start of high school. Grasso and Shea (1979) included high school educational aspirations as a variable in some of their equations but they did not include aspirations as a variable in other equations.

Findings

I classified studies into three types for the sake of exposition. Studies of the first type provide simple descriptive information. They report the proportion of students in each program who continue their education or training beyond high school. The second type of study uses regression analysis to determine the proportion of students in each program who would continue their education if the students in the programs were comparable in aptitude and background. The third type of study also uses regression analysis. The dependent variable in these regression analyses is the highest year of schooling that students complete.

Descriptive studies. Four studies provide simple descriptive statistics on the educational attainments of students in different curricular tracks (table 5.2). Two of the studies (Creech et al., 1977; Hilton, 1971) examined likelihood of enrollment in two- and four-year colleges. Three of the studies (Campbell & Basinger, 1985; Conroy & Diamond, 1976; and Creech et al., 1977) examined the likelihood that the students would pursue either postsecondary education or some other form of postsecondary training.

College enrollment. Creech and his colleagues based their report on follow-up data collected 18 months after students in the Class of 1972 sample had graduated from high school. They found that 69 percent of the academic students, 27 percent of the general students, and 14 percent of the vocational students entered two- or four-year colleges. Hilton (1971) reported simple descriptive statistics from a one-year follow-up of the Academic Growth Study sample. He found that 76 percent of the students in academic programs, 30 percent of the students in general programs, and 26 percent of the students in vocational programs enrolled in two- or four-year colleges. Thus, both studies found that vocational students were far less likely than academic students and only slightly less likely than general students to enroll in college after high school graduation.

Postsecondary education or training. Analyzing data from the New Youth Cohort of the National Longitudinal Surveys of Labor Market Experience (NLS-Youth) and the Class of 1972, Campbell and Basinger (1985) reported that 92 percent of academic students, 60 percent of general students, and 61 percent of vocational students pursued some form of postsecondary education. In their analysis of data from the 18-month follow-up of the Class of 1972, Creech et al. (1977) found that 81 percent of the academic students, 40 percent of the general students and 29 percent of the vocational students enrolled in a college or postsecondary training institution. Finally, Conroy and Diamond (1976) found that 81 percent of the nonvocational students and 48 percent of the vocational students in the Massachusetts Transition project had enrolled in some type of postsecondary institution after high school. Thus, using a broader definition of postsecondary education, these investigators found a smaller gap between academic and vocational students in educational attainment. They also found almost no gap between vocational and general students in attainment.

Table 5.2.—Percentage of students enrolling in postsecondary schools, by curricular program

Study	Curricular program			
	Academic	General	Vocational	Nonacademic
I. Percent enrolled in two- or four-year college				
Creech et al., 1977	69	27	14	21
Hilton, 1971	76	30	26	27
II. Percent enrolled in any postsecondary institution				
Campbell & Basinger, 1985	92	60	61	
Conroy & Diamond, 1976			48	
Creech et al., 1977	81	40	29	35

Table 5.3.—Probability of postsecondary enrollment by curricular program for students of average background

Study	Curricular program			
	Academic	General	Vocational	Nonacademic
I. Likelihood of enrollment in two- or four-year college				
Grasso & Shea, 1979	.62	.32	.21	.29
II. Likelihood of enrollment in any postsecondary institution				
Campbell & Basinger, 1985	.73	.68	.65	
Creech et al., 1977	.75			.44
Grasso & Shea, 1979	.81	.64	.62	.63

Conclusions from descriptive studies. Although the proportion continuing on to college varies from one data set to another, the similarities in the data are more striking than the differences. In each of the data sets, the vast majority of academic students and a minority of general and vocational students enroll in college programs. On the average about 75 percent of academic students, 30 percent of general students, and 20 percent of vocational students enroll in two- or four-year colleges, and about 85 percent of academic students, 50 percent of general students, and 45 percent of vocational students pursue some form of postsecondary education or training. The difference between academic and nonacademic programs in postsecondary enrollments is large; the difference between general and vocational programs is small.

Regression analyses with dichotomous outcome variables. The students who pursue vocational and nonvocational programs differ in aptitude and other characteristics on entry into high school, and vocational and nonvocational students also follow different curricula during the high

school years. Each of these factors could lead to different educational outcomes for vocational and nonvocational programs. Simple descriptive analyses like those described above do not help us decide whether student characteristics or program characteristics determine outcomes. Regression analysis with longitudinal data promise to provide a sounder basis for conclusions.

One type of regression analysis examines a dichotomous measure of educational attainment. Students who continue their education form one category; students who do not continue in school form the other category. The goal of the regression analyst is to determine whether curricular track is related to category membership when other influences on educational attainment are held constant. Three sets of investigators carried out this type of analysis (table 5.3). Grasso and Shea (1979) focused on enrollment in two- or four-year colleges. Campbell and Basinger (1985), Creech et al. (1977), and Grasso and Shea (1979) looked at curricular tracks and enrollment in any type of postsecondary institution, including training institutes.

College enrollment. Grasso and Shea (1979) examined the influence on college enrollment of student aptitude, background, and curricular track, but they did not study the role that college aspirations played. They found that the likelihood of an average student enrolling in a two- or four-year college was 62 percent if the student followed an academic program in high school; the likelihood of the same student going to college was 21 percent if the student followed a vocational program and 32 percent if the student followed a general program. Thus, Grasso and Shea found that students from academic and vocational programs differed in likelihood of college enrollment even when they were similar in aptitude and background. Similar students from general and vocational programs, however, differed only slightly in likelihood of enrollment in college.

Postsecondary education or training. Campbell and Basinger (1985) reported that the effects of curricular track are small when family background, college aspirations, and 10th grade test scores are controlled. They found that vocational graduates are 8 percent less likely than similar academic program graduates and 3 percent less likely than similar general program graduates to enroll in postsecondary educational institutions. For a student who is average in background, aspirations, and aptitude, the likelihood of enrolling in a college or training institute would be 73 percent if the student graduated from a high school academic program, 68 percent if the student graduated from a general program, and 63 percent if the student graduated from a vocational program.

Creech et al. (1977) found that curricular track had a somewhat stronger effect. They reported that the probability of postsecondary enrollment depends on high school curricular program. They found that students in academic programs who are average in scholastic aptitude, socioeconomic background, and educational aspirations have a 75 percent chance of continuing their education beyond high school; similar students in nonacademic programs have a 44 percent chance of continuing.

Grasso and Shea's (1979) results also suggest that curricular programs have an effect on educational attainment. One of their analyses examined the likelihood of a student's enrollment in either a college or postsecondary vocational institute. The analysis controlled for scholastic aptitude and socioeconomic origins but not for educational aspirations. They found that the likelihood of an average student enrolling in either a college or a postsecondary training institute was 81 percent if the student pursued an academic program in high school. The likelihood of postsecondary enrollment for the same student was 62 percent if the student pursued a vocational program in high school.

Conclusions from analyses with dichotomous outcome variables. It is clear that the educational attainments of academic and vocational students are different. All studies show that aca-

demic students are more likely than vocational students to enroll in college. It is also clear that regression analyses that hold constant student aptitude, background, and aspirations do not change the picture much. The regression analyses show that academic students are more likely to enroll in postsecondary institutions than are vocational students who appear to be comparable in aptitude, background, and aspirations.

Such results seem to show that curricular tracks shape educational attainment, but these regression comparisons are methodologically flawed. It is important to note that students selecting academic and vocational programs differ in many characteristics that influence their decisions about program enrollment. For regression results to be accurate, researchers would have to measure all these characteristics fully and reliably. Available surveys simply do not meet this requirement. They either ignore student educational aspirations, or they use crude and unreliable measures of student aspirations. It is a good idea therefore to treat with skepticism results from regression comparisons of academic and vocational students.

In addition, comparisons of educational attainments of academic and vocational students miss the point. After all, students usually enroll in college-prep programs because they intend to go to college; students often enroll in vocational programs because they do not intend to go to college. Why compare the two programs on whether they channel students into college? The criterion seems appropriate for college-prep programs but inappropriate for vocational programs. Asking whether vocational programs channel vocational students into college is, in effect, asking whether the programs route students to places where they do not choose to go. Grasso and Shea (1979) are among those who believe that it is inappropriate therefore to compare academic and vocational programs on their effects on college enrollment. They believe that it is more appropriate to compare programs on common goals.

Comparing general and vocational students makes more sense. General and vocational students are similar in academic aptitude and background, and the two groups do not differ radically in their goals. Survey results also show that the two groups are similar in likelihood of enrollment in college and postsecondary training institutions. About 30 percent of those from general programs and about 20 percent of those from vocational programs enroll in college. About 50 percent of those from general programs and 45 percent of those from vocational programs pursue some form of postsecondary education or training. Holding constant aptitude, background, and aspirations in regression analyses does not change the picture much. With background, aptitude, and aspirations controlled, students from general programs are slightly more likely than vocational students to go on to college, but the two groups do not differ at all in likelihood of pursuing some form of postsecondary education or training.

Regression analysis with continuous outcome variables. Another type of regression analysis used a continuous measure of educational attainment. The outcome variable in these analyses was number of years of postsecondary education or an equivalent measure. Five research studies used such continuous measures (table 5.4). Two of these studies (Grasso & Shea, 1979; Hilton, 1971) investigated attainment in two- or four-year colleges. The other three studies (Hauser et al., 1976; Jencks & Brown, 1975; Vanfossen et al., 1987) investigated attainment in two- or four-year colleges or vocational institutes.

Table 5.4.—Estimated postsecondary attainment (in z-scores), by curricular program for students of average background

Study	Curricular program			
	Academic	General	Vocational	Nonacademic
	I. College only			
Grasso & Shea, 1979	0.41 (14.0)	-0.24 (12.6)	-0.40 (12.3)	-0.29 (12.5)
Hilton, 1971				
—One-year follow-up	0.15			-0.25
—Three-year follow-up	0.15			-0.24
	II. College and/or postsecondary training			
Hauser, Sewell, & Alwin, 1976	0.16 (13.7)			-0.17 (13.1)
Jencks & Brown, 1975	0.13 (14.4)			-0.13 (14.0)
Vanfossen, Jones, & Spade, 1987	0.28	-0.17	-0.27	-0.20

NOTE: Values in parentheses are years of schooling completed.

College enrollment. Grasso and Shea (1979) found that students who are average in socioeconomic background and scholastic aptitude would finish 14.0 years of schooling if they were graduates of an academic program in high school, 12.6 years if they were graduates of a general program, and 12.3 years if they were graduates of a vocational program. The average number of years of schooling for all students in the total sample was 13.13, and the total standard deviation was 2.06. The z-score equivalents for number of years of schooling are therefore 0.41 for the academic program, -0.24 for the general program, and -0.40 for the vocational program. The difference in years of schooling for students in academic vs. vocational programs is equivalent to 0.81 standard deviations. The difference between students in general vs. vocational programs is equal to 0.16 standard deviations.

Cohen (1977) has characterized differences of 0.2 standard deviations as small, differences of 0.5 standard deviations as moderate, and differences of 0.8 standard deviations as large. By Cohen's guidelines, placement in an academic rather than vocational program will have a large effect on years of schooling; placement in a general rather than vocational program will have only a small or trivial effect on years of schooling.

Like Grasso and Shea, Hilton (1971) analyzed educational attainment without taking educational aspirations into account. He categorized educational attainment on a five-point scale in his one-year follow-up and on a ten-point scale in a five-year follow-up. In his one-year follow-up study, he found that students who were average in socioeconomic background and aptitude differed by 0.40 standard deviations in educational attainments if they were in academic and nonaca-

demic programs in high schools. Results from Hilton's five-year follow-up were remarkably similar. Hilton's study suggests that curricular programs have a moderate effect on educational attainment.

Postsecondary education or training. Hauser et al. (1976) analyzed data from the Wisconsin class of 1957. Like Grasso and Shea (1979) and Hilton (1971), they did not include educational aspirations in their prediction equations but instead focused on the effects of academic aptitude and socioeconomic background. They found that the average number of years of postsecondary schooling was 13.7 for average students who were in an academic program in high school, and 13.1 for comparable students in a nonacademic program. The average z-score on a scale of educational attainment was 0.16 for those in the academic program and -0.17 for those in the nonacademic program. The difference of 0.33 standard deviations would ordinarily be considered a small to moderate difference.

Jencks and Brown (1975) used five-year follow-up data collected as a part of Project Talent in their analysis. They also distinguished between only two curricular tracks, academic and nonacademic. Although this limits the usefulness of their results, their study is an excellent one in other respects. Jencks and Brown's predictor variables included measures of background, aptitude and achievement, grades, and educational plans, and they measured educational attainment as years of postsecondary schooling completed. They found that students who are average in background, aptitude, grades, and educational plans would complete 14.4 years of schooling if they followed an academic program in high school, and 14.0 years of schooling if they followed a nonacademic program. The z-score equivalents are 0.13 for academic students and -0.13 for nonacademic students. The difference of 0.26 standard deviations is a small difference.

Vanfossen et al. (1987) used HSB data to estimate curricular effects on educational attainment. They examined effects of academic, general, and vocational programs separately, but they restricted the sample for their analysis to *stayers*, students who did not change curricular programs between their sophomore and senior years. In addition to curricular program, predictors in their regression equations included measures of scholastic aptitude, socioeconomic background, aspirations, and so on. They found that average students would be 0.28 standard deviations above the mean on a scale of educational attainment if they followed academic programs in high school. They would score 0.17 standard deviations below the mean if they were in general programs and 0.27 standard deviations below the mean if they were in vocational programs. The difference in educational attainment between comparable students in academic and nonacademic programs is therefore 0.48 standard deviations.

Conclusions from analyses with continuous outcome variables. The overall picture is similar to the one that emerged from studies that used dichotomous outcome variables. Like those studies, these show that students from academic and nonacademic programs complete different amounts of schooling. Controlling for factors such as ability, background, and aspirations of the students does not equalize attainment outcomes. The typical student would complete about 14 years of schooling if enrolled in an academic program and about 12.5 years if enrolled in a nonacademic program. The attainment gap would be somewhat less if postsecondary vocational training were counted as postsecondary schooling, but even with this broader criterion of educational attainment, there would still be an attainment gap between academic and nonacademic students.

It is impossible to attribute this attainment gap to curricular programs, however. As I have already pointed out, academic and nonacademic students differ greatly in their educational goals at the start of high school, and it is extremely unlikely that their goals are measured reliably or adequately in survey

studies. Without good measures of educational aspirations, regression analyses cannot control adequately for existing differences in goals. The results of these regression comparisons of academic and nonacademic students should therefore be regarded with extreme suspicion.

It is more relevant to compare the educational attainments of students from general and vocational programs. Students who choose these two types of programs are similar in aptitude and background, and they do not differ radically in their educational aspirations. Regression results also suggest that the two groups are similar in educational attainments. Average students would complete about three months of college if they graduated from a vocational program in high school and about five months if they graduated from a general program.

Conclusions

The educational attainments of academic and vocational students are clearly different. About 75 percent of students from academic programs and about 20 percent of students from vocational programs enter college. The average student from a high school academic program completes about two years of college; the average student from a vocational program completes only a few months. The difference between academic and vocational students is therefore substantial, and regression results suggest that even if similar students enrolled in academic and vocational programs, they would still differ in how much schooling they complete.

These regression comparisons are inadequate, however, and their results are misleading. It is important to note that the groups being compared differ profoundly in educational aspirations at the start of high school. Students usually follow college-prep programs because they intend to go to college; students often follow vocational programs because they do not intend to go to college. The goals of the two groups seem almost by definition to be non-overlapping. Statistical manipulation can never equate the aspirations of groups with such fundamentally different goals, and so regression comparisons of educational attainments of academic and nonacademic students must be treated with skepticism.

Comparing postsecondary attainments of academic and vocational students also seems to be beside the point. Why compare the number of college enrollments from college-prep programs and from programs not designed to prepare students for college? It seems the equivalent of comparing medical school enrollments from pre-med and pre-law programs, or graduate school enrollments from four-year colleges and postsecondary training institutes. The criterion fits one of the programs being compared but not the other. It makes better sense to compare educational programs by examining their achievement of shared objectives.

Regression comparisons of vocational and general students are less problematic. The educational aspirations of students in vocational and general programs are not totally different, and the students who select the two programs are similar in many respects. Regression results also show that the educational attainments of students who complete vocational and general programs are similar. About 20 percent of vocational students and about 30 percent of general students enroll in college after high school. The average student from a vocational program completes several months of college, and the average student from a general program completes only a few months more. Regression results suggest that these difference in college attendance cannot be explained entirely by differences in background, aptitude, and aspirations of vocational and general students. If the same students took vocational and general programs in high school, they would still differ slightly in likelihood of college enrollment.

The results change, however, when we include all of postsecondary education in the picture. General and vocational students differ only slightly in likelihood of pursuing some form of postsecondary education or training. About 50 percent of general students and 45 percent of vocational students pursue postsecondary education of some form. Regression results suggest that even this small difference is probably due to group differences in background, aspirations, or aptitude. If the same students took vocational and general programs in high school, they would not differ at all in their likelihood of involvement in some form of postsecondary education.

Participation in vocational programs thus seems to have a small effect on college enrollment but no effect on the likelihood that a student will pursue some form of postsecondary education or training. General students are slightly more likely than comparable vocational students to enroll in college, but they are no more likely than vocational students to seek some form of postsecondary education or training. With a greater emphasis on vocational education in high school, we would expect a slight decline in the number of students going on to college but no decline in the number of students involved in postsecondary education. Some policy makers might find the decline in college attendance unsettling, but other would not find it troubling. They might argue that vocational programs are not meant to increase the likelihood of college enrollment and that their success should be measured by other standards.

Job Satisfaction

You cannot tell how satisfied people will be with a job simply by looking at the job itself. Research shows that job satisfaction is only slightly related to the status of jobs, their educational requirements, and their other characteristics. Jencks (1972), for example, has reported that job satisfaction correlates only .20 with occupational status and only .12 with educational attainment. These are very low correlations, but they have very important implications. They suggest that people who hold high-status jobs requiring high levels of education are only slightly more satisfied than people who hold low-status jobs. The correlations also suggest that people who do the same jobs may differ greatly in their levels of satisfaction.

Why is the relation between job satisfaction and job characteristics so low? One possibility is that job satisfaction simply reflects a person's overall outlook on life. Some people are easily satisfied, others are never satisfied. A person's disposition may be more important for her job satisfaction than the job she actually holds. A more likely possibility, however, is that people evaluate their jobs by comparing them with the jobs of their friends, not by comparing them with some hypothetical national norm. Laborers compare themselves to other laborers, executives compare themselves to other executives, and a laborer may therefore be as satisfied with his job as an executive is with his.

A number of researchers have reported that graduates of vocational programs are usually very happy with their jobs (Grasso & Shea, 1979; Mertens et al., 1980, Mertens & Gardner, 1981). In fact, vocational graduates may be happier with their jobs than other graduates are with theirs. A cynical explanation is that placement in a vocational track lowers the aspirations of young people so that vocational graduates are satisfied with less. A more plausible interpretation of the finding, however, is that vocational graduates are more satisfied with their jobs because they are more likely than other students to find jobs that match their skills.

Research studies of job satisfaction of vocational graduates are fairly simple in design, and they do not provide a decisive test of competing theories of job satisfaction. My purpose in this chapter

is therefore somewhat limited. I describe relevant studies of job satisfaction, express results on a common scale, and draw conclusions about the satisfaction levels of vocational and other graduates. Because of the limited number of studies available and because the studies are so simple in design and analysis, it is impossible to determine from them what leads to job satisfaction for vocational and nonvocational high school graduates.

Studies

I located the studies that I review in this chapter in two steps. I first carried out a computerized search of the data base of the Educational Resources Information Clearinghouse (ERIC). I then examined the reference lists in the documents that I located in the search. The ERIC search itself covered the period from 1982 through September 1993 and used the terms *secondary education*, *vocational education*, and *job satisfaction*. The search yielded 23 reports and articles. Although none of these contained directly useful data, the search did yield relevant background reports, and it ultimately led to a review by Mertens et al (1980) that turned out to be a good source for locating studies of job satisfaction.

By branching from the Mertens et al. review, I located a total of six studies with useful results (table 6.1). The six studies have certain things in common. Each is a survey study in which graduates of different high school programs replied to questions about their job satisfaction, and each covers either a national or state population of young people. The studies differ from each other, however, in several obvious ways:

- The researchers asked slightly different questions. The National Longitudinal Survey of Labor Market Experience, for example, asked young workers how much they liked their jobs (Grasso & Shea, 1979). The Class of 1972 survey asked how satisfied young workers were with their jobs (Woods & Haney, 1981). People are apparently more likely to say that they like their jobs very much than that they are very satisfied with them.
- The researchers gave students different response options. Conroy and Diamond's (1976) respondents, for example, chose among three options: *very satisfied*, *satisfied*, and *not satisfied*. Herrnstadt, Horowitz, and Sum's (1979) respondents, on the other hand, chose among five options: *very satisfied*, *quite satisfied*, *somewhat satisfied*, *not very satisfied*, or *not at all satisfied*.
- Researchers reported their results in different ways. Most reported the percentage of students who chose each response option (Andrew & Roberts, 1974; Conroy & Diamond, 1976; Herrnstadt et al., 1979). Woods and Haney (1981), however, reported only the percentages who reported extreme or moderate satisfaction, and Grasso and Shea (1979) reported only the percentage who like their jobs very much.
- Researchers used different follow-up periods. Herrnstadt et al. (1979) examined follow-up data collected 18 months after students graduated from high school. Andrew and Roberts (1974) examined data collected four years after high school graduation, and Conroy and Diamond (1976) examined data from a six-year follow-up.

Table 6.1.—Description of six studies of track differences in job satisfaction

Study	Data collection	Data analysis
Andrew & Roberts, 1974	Project sent questionnaires to 1970 graduates of eight high schools in Arkansas. Receiving questionnaires were: (a) all vocational graduates; (b) all graduates with GPAs below 2.25; (c) all graduates with GPAs above 2.25 who did not go on to college. The questionnaires were sent out in spring of 1974, four years after students graduated from high school.	Descriptive analysis. Track (vocational vs. other) determined from high school records. Dependent variables were percentage very satisfied, satisfied, dissatisfied, and very dissatisfied with various aspects of their jobs.
Conroy & Diamond, 1976	Massachusetts Transition project surveyed approximately 8,000 students in classes of 1969 and 1973 by mail questionnaire during summer and fall of 1975.	Descriptive analysis. Program (vocational vs. nonvocational) apparently determined from questionnaire response. Dependent variable: percentage very satisfied, satisfied, and not satisfied with their jobs.
Grasso & Shea, 1979	National Longitudinal Survey of Labor Market Experience (NLS–LME) interviewed a national sample of 5,000 men aged 14 to 24 in fall 1966 and a sample of 5,000 women aged 14 to 24 in 1968. Analysis restricted to (a) high school graduates, (b) who did not attend college, and (c) who were in grades 10–12 during the base years and who were contacted during the 1972–73 follow-up.	Descriptive analyses. Curricular program determined from self-report in follow-up surveys. Satisfaction measure is percentage responding "like very much" to question "How do you feel about the job you have now."

Table 6.1.—Description of six studies of track differences in job satisfaction—Continued

Study	Data collection	Data analysis
Herrnstadt, Horowitz, & Sum, 1979	The project investigated the labor market experience of 427 male students from 18 high schools in 9 Massachusetts towns. Students were interviewed while in high school and 18 months after graduation. Comparison group were students in a general program in high school.	Descriptive analyses. Program membership determined from school records. Dependent variable is percentage indicating various degrees of job satisfaction: very, quite, somewhat, not very, and not at all satisfied.
Woods & Haney, 1975	Class of 1972 survey tested approximately 18,000 high school seniors from more than 1,000 schools nationwide in 1972. Follow-up questionnaire administered 18 months after graduation in fall 1973 and 4 years after graduation in 1976. Analysis restricted to (a) public school students, (b) students who reported their last high school program was either general or vocational, and (c) students who did not pursue any postsecondary education.	Descriptive analysis. Curricular program determined from student report. Dependent variable: percentage indicating that they were satisfied or very satisfied with their jobs.
Woods & Haney, 1975	Data from the National Longitudinal Survey of Labor Force Behavior (NLS-Youth), a survey of a nationally representative sample of approximately 13,000 young people who were 14 to 21 years old in 1978. Used in this analysis were those aged 18–22 in January 1979. Their 1979 and 1980 interviews, supplemented by high school transcripts, provided the data.	Descriptive analysis. Curricular program determined from student questionnaire answers. Dependent variable: percentage indicating that they liked their jobs either moderately or very much.

Table 6.2.—Percentage of high school graduates expressing a high degree of job satisfaction, by curricular program

Study	Curricular program	
	Vocational	Nonvocational
Andrew & Roberts, 1974	37%	42%
Conroy & Diamond, 1976	59%	52%
Grasso & Shea, 1979	55%	46%
Herrnstadt et al., 1976	33%	22%
Woods & Haney, 1981		
Class of 1972	27%	21%
NLS–Youth	48%	33%

- Researchers compared vocational graduates to different groups. The comparison groups used by Woods and Haney (1981) and Grasso and Shea (1979) consisted of graduates of general programs in high school who did not go on to college. Conroy and Diamond (1976), on the other hand, compared students who were enrolled in vocational programs in high school with all other students at the same high schools.

The variation among studies is large enough to ensure some variation in results, but it is not large enough to prevent a pattern from emerging.

Findings

The simplest way to see the pattern is by examining the percentage of vocational and nonvocational graduates who reported a high degree of job satisfaction (table 6.2) Andrew and Roberts did not find that vocational graduates were more satisfied than other high school graduates, but each of the other five studies did. The results indicate that graduates of vocational programs are more satisfied with their jobs than other high school graduates are with theirs.

Andrew and Roberts (1974) surveyed vocational and nonvocational graduates of the class of 1970 in eight Arkansas high schools in 1974, or after four years. They examined responses of all vocational graduates, but they restricted their sample of nonvocational graduates to students from two groups: (a) all those with grade-point averages less than 2.5; and (b) all those with grade-point averages greater than 2.5 who planned not to go to college. They found no significant difference between the two groups in job satisfaction. They reported, however, that a greater proportion of vocational graduates expressed satisfaction with certain aspects of their present jobs. On a question about overall job satisfaction, however, a slightly higher proportion of nonvocational graduates indicated that they were very satisfied, and a slightly higher proportion of nonvocational graduates also indicated that they were dissatisfied with their jobs.

Conroy and Diamond (1976) sent questionnaires to a statewide sample of Massachusetts students from the classes of 1969 and 1973 during summer and fall of 1975. They classified the respondents as occupational and nonoccupational based on their questionnaire responses. They found that occupational students were more satisfied than nonoccupational students with their jobs. For example, 59 percent of the occupational students reported themselves to be very satisfied with the jobs, whereas 52 percent of the nonoccupational students said that they were very satisfied.

Grasso and Shea (1979) analyzed NLS-LME data from young men and women who completed high school and who did not go on to college. Grasso and Shea asked these young people in the base years of the survey in 1966 and 1968, as well as in later follow-ups, "How do you feel about the job you have now? Do you like it very much, like it fairly well, dislike it somewhat, or dislike it very much?" They found that graduates from vocational programs were more satisfied than graduates of general programs. This was true for men and women, blacks and whites. Overall, 55 percent of the vocational graduates reported high degrees of satisfaction, whereas 46 percent of the general graduates said that they liked their jobs very much. Academic students fell between vocational and general students in their level of job satisfaction.

Herrnstadt et al. (1976) examined the post-high-school job experiences of more than 400 male graduates of 18 high schools in nine Massachusetts cities and towns. They first interviewed the students during their senior year in high schools, and they later contacted the students again for three follow-up interviews during the 18-month period that followed high school graduation. They found that job satisfaction differed for students in different curricular programs. A total of 33 percent of graduates of vocational programs (cooperative or regular programs) reported a high degree of job satisfaction. In contrast, 22 percent of the graduates of general programs indicated a high degree of satisfaction.

Woods and Haney (1975) carried out secondary analyses of two national data sets. The first set of data came from the Class of 1972 survey of 18,000 high school seniors. Woods and Haney's analysis of Class of 1972 data was restricted to young people who filled out follow-up questionnaires 18 months after graduation in fall of 1972 and 4 years after graduation in 1976. The students whose data they examined were public school graduates who did not pursue any postsecondary education and who reported that their last high school program was either general or vocational. The second set of data came from the National Longitudinal Survey of Labor Force Behavior (NLS-Youth), a survey of a nationally representative sample of approximately 13,000 young people who were 14 to 21 years old in 1978. Woods and Haney examined data from white students in the sample who graduated from high school and did not pursue any postsecondary education.

The Class of 1972 survey asked young people how satisfied they were with their jobs. Different portions of those in vocational and general programs indicated that they were "very satisfied." In the four-year follow-up, 27 percent of the vocational and 21 percent of the general students responded indicated that they were very satisfied.

The NLS-Youth asked young people about how much they liked their jobs. Again, different percentages of those in vocational and general programs indicated that they liked their jobs "very much." Woods and Haney reported results separately for those who had left school recently (18- and 19-year-olds) and those who had been out of school for a longer time (20- to 22-year-olds). For the 20- through 22-year-olds, 48 percent of the vocational and 33 percent of the general students indicated that they liked their jobs very much.

Conclusions

Mertens et al. (1980) concluded that vocational graduates are as satisfied, or more satisfied, with their jobs than other students. My review of relevant studies suggests that this conclusion is correct. In five of the six studies that I reviewed, vocational students were more satisfied than other students with their jobs. In a typical study, 44 percent of vocational students and only 37 percent of comparable general students indicated high levels of job satisfaction.

Woods and Haney (1981) refrained from drawing conclusions about job satisfaction of vocational students. They thought that differences between vocational and other graduates (a) appeared only at the highest levels of satisfaction and (b) depended on the questions that were used in a survey. Vocational students were more likely to express extremely high levels of job satisfaction on questions asking them how much they liked their jobs. But the differences seemed less clear in the numbers expressing lower levels of satisfaction, and especially on questions asking about job satisfaction rather than liking. I do not share Woods and Haney's reluctance to draw conclusions. The relationship between satisfaction and curricular program is a reliable one. It emerges in almost every study.

The main obstacle to drawing sound conclusions about vocational education and job satisfaction is therefore not the reliability of findings. Instead, it is the limited goals in most studies of job satisfaction. The studies that I reviewed are one-variable investigations that do not probe beneath surface relationships. They show that there is a relationship between high school curricular program and job satisfaction, but they do not show what lies behind the relationship. Differences in satisfaction could be attributable to the high school curricula themselves or to the characteristics of the students who opt for the different curricula. More powerful research methods must be used to disentangle the influence of these factors.

Implications and Conclusions

Reviews of grouping and tracking research seldom give vocational education the attention it deserves. Some of the reviews focus on differences between upper- and lower-track academic courses and ignore vocational classes entirely. Other reviews lump general and vocational students together into a single track–the nonacademic track–and contrast this track to an academic one. The academic bias of the reviews thus comes through. The reviewers use the academic track or the upper tier of academic classes as a yardstick against which to measure everything else and sometimes forget to mention vocational education.

The neglect of vocational education in research reviews is distressing because important questions are being raised today about the effectiveness of vocational education. Are disproportionate numbers of minorities and poor children shunted into the vocational track? Do these students receive an inferior education there? Are they taught low-status subjects from low-status teachers? Would everyones needs be better met in one-track schools? These questions need to be answered, and the answers to the questions need to be based on careful analyses of evidence not hearsay and stereotyping.

To provide some answers, I reviewed 25 years of research findings on vocational education. I first systematically searched the literature for studies of educational outcomes of vocational education, and I examined hundreds of studies that emerged from my computer searches of library data bases. I then statistically described and analyzed the results of the studies that systematically compared outcomes in vocational and other school programs. I found ample support in the studies for several important conclusions about vocational education.

Conclusion I: Participation in vocational programs increases the likelihood that non-college bound youngsters will complete high school.

Analyses of survey data suggest that participation in a vocational program decreases the dropout rate by about 6 percent for youngsters who are not college-bound. Some studies suggest that the dropout-preventing effects of vocational programs may be even higher under certain circumstances.

The dropout-preventing effects of vocational education are probably larger in high dropout areas, and the effects of concentration in a vocational program are probably more dramatic than the effects of mere participation.

There should be no question that the dropout-preventing effect of vocational education is an important one, however. About 450,000 students in nonacademic programs drop out of high school each year. If vocational education were not an option for high school students, the number of dropouts would undoubtedly be higher. The dropout rate for youngsters currently in vocational programs might go up by 6 percent if these youngsters had to pursue other programs in high school. The total number of dropouts from those not in college-prep programs would therefore increase from 450,000 to 500,000.

Although other factors might contribute to these differences in dropout rates, the most likely explanation for the low dropout from vocational programs is that a vocational curriculum appeals to students who are not college-bound. We know, for example, that vocational courses are among those that students like best in high school. It seems likely therefore that high-risk students stick with vocational education because they find it interesting, relevant, and rewarding. They drop out of general programs because they find them less interesting, relevant, and rewarding.

Conclusion II. Students from vocational programs score at about the same level on standardized tests in core subjects as they would if they pursued general programs, but vocational students might score slightly higher if they completed a full program of academic courses.

Test scores of high school students completing academic and vocational programs are clearly different. Academic students usually score at the 71st percentile on standardized achievement tests given at the end of high school (or about 0.56 standard deviations above the mean); vocational students usually score at the 34th percentile (or about 0.41 standard deviations below the mean). The achievement gap at high school graduation is therefore large. The question is, What causes it?

Regression results suggest that the most important cause of the achievement gap is self-selection. If the same students enrolled in academic and vocational programs, graduates of the two programs would differ very little in test scores at the end of high school. A second factor contributing to the achievement gap is the different number of advanced courses in core subjects taken by academic and vocational students. Academic students take more of these advanced courses. If vocational students were as academically strong as college-prep students at the beginning of high school *and* they took as many advanced courses in core areas as college-prep students do, their test scores would be nearly indistinguishable from those of college-prep students at the end of high school.

It is possible to quantify these results. The difference in test scores of academic and vocational students on standardized tests at the end of high school is equal to about 1.0 standard deviation. If similar students enrolled in academic and vocational programs, the gap would be about 0.2 standard deviations. Thus, 80 percent of the difference in test scores of academic and vocational students at the end of high school is due to the difference in aptitude of the students who enter the programs. If vocational students were similar to academic students in aptitude and took the same number of advanced courses in core subjects, the achievement gap between academic and vocational students would be no more than 0.1 standard deviations. Thus, an additional 10 percent of the achievement gap is due to the different number of advanced courses taken by academic and vocational students. The remaining 10 percent of the gap is due to other curricular and program factors.

Statistical analysis shows that general and vocational programs have roughly the same effects on student achievement. General and vocational students score at nearly identical levels on standardized achievement tests given both at the beginning and at the end of high school. General students

score on the average at the 34th percentile (or about 0.41 standard deviations below the mean); vocational students score on the average at the 32nd percentile (or about 0.47 standard deviations below the mean). Regression analyses suggest that program effects are trivial. If the same students enrolled in general and vocational programs, their test scores would differ by less than 0.1 standard deviation, a trivial amount, at the end of high school.

I draw two implications from these regression analyses of test-score data. First, test-score performance would go up slightly if vocational students were to switch to academic programs or if they were to increase their load of advanced courses in basic subject areas. Second, shifting vocational students to general programs would have no effect on test scores. Their performance on standardized tests in core subjects would not go up or down.

Conclusion III. Students from vocational programs would be only slightly more likely to pursue postsecondary education if they pursued other curricular programs in high school.

The educational attainments of young people who complete academic and vocational programs while in high school are clearly different. About 75 percent of students from academic programs and about 20 percent of students from vocational programs enroll in college. The average student from a high school academic program completes about two years of college; the average student from a vocational program completes only a few months. The difference between academic and vocational students is therefore substantial, and regression results suggest that even if similar students enrolled in academic and vocational programs, they would still differ in their likelihood of college enrollment.

The regression analyses that produce these results are seriously flawed, however, and the results themselves are misleading. It is important to note that students who pursue academic and vocational programs differ greatly in educational aspirations at the start of high school. Students follow college-prep programs because they intend to go to college; students follow vocational programs because they do not intend to go to college. Their goals seem by definition to be non-overlapping. No statistician on earth could ever successfully equate the aspirations of students with fundamentally different goals, and so regression comparisons of educational attainments of statistically equated academic and nonacademic students must be treated with skepticism.

Regression comparisons of educational attainments of vocational and general students are less problematic. The immediate educational aspirations of students in vocational and general programs are not totally different, and the students who select the two programs are similar in many respects. Regression results show that the educational attainments of high school students who complete vocational and general programs are also similar. About 20 percent of students from vocational programs and about 30 percent of general students go on to college. The average student from a vocational program completes several months of college, and the average student from a general program completes only a few months more. Regression results suggest that these differences cannot be explained entirely by differences in background, aptitude, and aspirations of vocational and general students. If the same students took vocational and general programs in high school, they would still differ somewhat in their educational attainments.

Participation in vocational programs thus seems to have a small effect on a student's educational attainment. Students who participate in vocational programs are slightly less likely than comparable general students to go on to college; on the average they complete 2 or 3 months less of schooling than comparable students in general programs. With a greater emphasis on vocational education in high school, we would expect a slight decline in the number of students going on to college, and we would expect students on the average to attend college for a few months less.

Some policymakers might find this decline in college attendance unsettling. Others might not find it troubling. They might argue that vocational programs are not meant to increase the likelihood of college enrollment and that their success should be measured by other standards.

Conclusion IV. Graduates of vocational programs are more satisfied than other high school students with their jobs.

Vocational graduates express more satisfaction with their jobs than other high school graduates do. Although this difference in job satisfaction appears in five out of six studies, it is a fairly small difference. In a typical study, 44 percent of vocational students and 37 percent of comparable general students indicated high levels of job satisfaction. In addition, no sweeping conclusions can be drawn from the study findings because most studies of job satisfaction are limited in goals and methodology. The studies are single-variable investigations that do not probe beneath surface appearances. They show that there is a relationship between high school curricular program and job satisfaction, but they do not show what lies behind it. Differences in satisfaction might be attributable to high school curricula or to the characteristics of the students who opt for the different curricula. More powerful research methods must be used to disentangle the influence of such factors.

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The Impact of Academic Course Work on Labor Market Outcomes for Youth Who Do Not Attend College: A Research Review

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The author is grateful for helpful comments from David Boesel, Bill Clune, Kevin Hollenbeck, David Raffe, and James Rosenbaum.

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Abstract

Does academic course work pay off for students who do not attend college? This paper reviews research on four labor market outcomes of academic courses: hourly wages, employment (versus unemployment), annual earnings, and occupational status. Academic courses are expected to contribute to labor market outcomes by improving cognitive skills. Consequently, the paper also examines possible effects of academic courses on test scores, and of test scores on labor market outcomes. The studies reviewed show small positive effects of academic courses on wages for women, while the results are inconsistent for men. Positive effects on employment appear for both men and women in the one study that was well-suited to address this question. Effects on annual earnings are highly inconsistent, with some studies indicating positive effects, others indicating a negative impact, and still others suggesting no relation at all. Effects on occupational status, by contrast, are consistently positive. Finally, academic courses tend to raise academic skills, and academic skills improve job outcomes. Immediately after high school, students with higher test scores are more likely to be employed but they have little or no advantage in wages. Six years after high school, however, most studies indicate that students whose test scores were higher at the end of high school are earning higher wages. When one compares the 1970s to the 1980s, moreover, this benefit appears to have increased over time. Qualitative research on selection for employment supports the conclusion that academic work in high school helps one find a job and rise in one's occupation more than it aids initial wages.

Introduction

Since the transformation of secondary schooling from an elite institution into one that is open to the full range of American youth, our educational system has struggled with the question of how best to prepare students who are not bound for four-year colleges. For the most part, the response has been located in the comprehensive high school, which divides students into vocational, general, and college-preparatory programs, according to students' purported capacities and interests (Trow, 1961; Conant, 1959, 1967). Despite the ubiquity of comprehensive high schools, questions remain about the adequacy of schooling provided to students outside the college track (e.g., Rosenbaum, 1976; Oakes, 1985). How much academic training should non-college-bound youth receive? Are they well served by the general track? Would they be better off in an academic program, even if they do not proceed to college after high school? Other chapters in this volume (Kulik; Rasinski) examine the merits of high school vocational training. My task is to assess the value of academic preparation for success on the job market among those who do not attend college. Would these students fare better at work if they took more academic courses in high school?

Of course, there are many reasons that students should engage in academic study at the secondary level, quite apart from any possible payoff in the labor market. Academic preparation keeps students' options open, in case they decide to attend college later. Among students who do not attend four-year colleges, moreover, those with more academic training in high school are more likely to enroll in junior and technical colleges. More generally, academic study is (at least potentially) intellectually enriching: It promotes appreciation of science, literature, and other benefits of modern life, and provides important preparation for citizenship. All these are valuable reasons for enrolling in academic courses in high school, but they are beyond the scope of my inquiry. I will return to them briefly only to place the findings of my investigation in a broader context.

This paper focuses on whether academic programs and courses contribute to the labor market's success of noncollege youth. I consider four aspects of labor market success: Being employed (versus unemployed), earning high hourly wages, achieving high annual earnings, and attaining occupational status. I focus mainly on outcomes shortly after high school (the first five years or so), but also review the few studies that have examined long-term effects. For the most part I discuss studies that address the question directly, with evidence on the relation between course work and labor market outcomes. I also take note of indirect evidence on the question, by linking studies of course work and academic achievement on the one hand, with studies of academic skills and labor market outcomes on the other.

These questions are of more than theoretical interest. A variety of recent reports have argued that non-college-bound youth are poorly prepared for life after high school (e.g., William T. Grant Foundation, 1988a, 1988b; Commission on the Skills of the American Workforce, 1990; Secretary's Commission on Achieving Necessary Skills, 1991, 1992, 1993). According to these studies, many young people entering the labor market after high school lack the necessary skills to become productive employees in the firms of today; even more so, they lack the training needed for the firms of tomorrow. Hence, we need to learn whether more rigorous and extensive academic preparation in high school would better enable these youth to find work and succeed on the job.

Why Should We Expect a Linkage?

Before turning to the evidence, I will address theoretical, practical, and statistical issues that must be borne in mind while weighing the evidence. What reasons are there to expect a linkage between academic preparation at the secondary level and success on the job market for noncollege youth? What problems are likely to arise in the attempt to estimate the strength of this linkage? Considering these questions sets the stage for reviewing the evidence.

Research in this area has mainly been motivated by a narrow policy agenda: In light of criticisms of vocational education, and in response to calls by national commissions for increased academic course work, we need to know how academic courses are related to success in the labor market. While these concerns are obviously important, placing them in a broader theoretical context will aid substantially in the interpretation of results. By anticipating the findings that may be expected, and considering how such findings may differ across studies depending on model and measurement differences, we will be in a better position to assess the evidence. Although studies in this literature have given more attention to the methodological complexities of estimating curriculum effects, it is also important to review statistical issues in preparation for interpreting evidence from varied analyses.

Theoretical and Practical Considerations

Straightforward application of human capital theory leads to the prediction that academic preparation is beneficial in the competition for jobs and wages after high school (e.g., Schultz, 1963; Becker, 1964). Academic study reinforces essential skills such as basic literacy and numeracy, which may help persons find and keep jobs and perform well in them. Academic courses also nurture general cognitive abilities, such as the capacity to learn, to think critically, and to work out a solution to a problem. These abilities may then aid performance in the workplace. Indeed, a large literature in personnel psychology indicates that cognitive ability is the strongest predictor of job performance in a wide range of occupations (see Hunter and Hunter, 1984, for a thorough review). Personal investment in the development of cognitive skills thus may pay off in the labor market.

It is well known that more years of schooling results in better jobs and higher pay for individuals (e.g., Blau and Duncan, 1967; Welch, 1974; Featherman and Hauser, 1978). Human capital theory interprets this evidence as an indication that capacities developed through schooling are utilized at work (e.g., Wise, 1975; Psacharopolous, 1987). One can make the same argument for academic course work in high school: these experiences provide new capacities and reinforce skills learned earlier, allowing individuals to find better jobs, to be more productive, and to earn higher pay. Recent support for this formulation comes from the Secretary's Commission on Achieving Necessary Skills (1991, 1992), which has reported that foundation skills such as basic reading and math abilities, communication and thinking skills, and the ability to work with others are important components of successful job performance (see also Cappelli and Rogovsky, 1993a, 1993b).

Practical Challenges to the Human Capital Formulation

A number of complications raise questions for the application of human capital theory in this context. First, even if skills learned in school aid job performance in general, one may question

whether skills learned in academic courses in high school are relevant for the types of jobs available to persons who obtain no more than a high school education: Studies of employers' needs indicate that entry-level jobs typically require eighth-grade reading and/or math skills (U.S. General Accounting Office, 1990; Levin, 1993; Rosenbaum and Binder, 1994.) In what, then, would students gain by enrolling in serious academic courses in high school?

One response to this question is that studies of academic course taking and achievement show gains in basic as well as advanced cognitive skills as a consequence of increased academic work (Jones et al., 1986; Gamoran, 1987a). Indeed, several studies show greater benefits to basic skills from college-preparatory courses than from remedial courses (Kerckhoff, 1986; Gamoran, 1987a, 1987b; Meyer, 1992; Kifer, in press). This finding may be less surprising if one bears in mind that many students fail to master what are considered eighth-grade skills while they are in junior high school (National Assessment of Educational Progress, 1990a, 1990b, 1993). The math curriculum in particular tends to be highly repetitive in American school systems; one international study called it a "spiral curriculum," referring to the large amount of time devoted to reviewing previous material before new concepts are introduced (McKnight et al., 1987). If these findings and interpretations are correct, then students who plan to cease their schooling after high school may still acquire useful skills in courses offered in an academic program in high school.

It may be that skills acquired in early high school courses are more relevant for work opportunities and performance than are skills offered in more advanced courses. In that case, the relation between academic courses and job success may be non-linear. That is, one may expect some payoff for increased academic study, but the benefits of additional work may diminish as more courses are added and the curriculum moves beyond what is applicable to entry-level jobs. The question thus becomes one of identifying the point at which such returns begin to diminish, or cease entirely.

Even if the benefits of additional academic studies are limited when one first enters the labor market, greater benefits may accrue as time passes. Higher-order cognitive abilities, such as problem-solving and critical thinking skills, and a heightened capacity for learning, may have limited relevance for entry-level jobs, but may lead to promotion and added productivity in more advanced positions in the workplace. Even more basic skills, such as those required to write a coherent memo or read an operations manual, may be rewarded not at entry level, but through promotion. Thus, one may predict that the benefits of academic courses in high school among those who do not attend college are likely to increase with work experience. More academic preparation in high school may provide a foundation for advancement at the workplace over time.

Another complication is that different occupations may vary in the extent to which academic preparation pays off. For example, the possibility of finding work and advancing in a white collar occupation may be enhanced by additional academic course work in English, while job success in a manual occupation could be much less sensitive to such academic training. Similarly, academic math courses may add to one's prospects of advancement in some fields, but not others. Recent technological advances have probably resulted in some convergence of required cognitive capacities; for example, extensive computerization of factories calls for increased math and reading skills among workers (National Commission on Excellence in Education, 1983; Secretary's Commission on Achieving Necessary Skills, 1991). Still, it would be useful to consider distinct payoffs for different fields of work from taking varied configurations of academic courses.

A final difficulty with predicting an impact of academic preparation on labor market outcomes for non-college youth is that effects that did or did not hold in the past, may differ in the future.

The Commission on the Skills of the American Workforce (1990) observed that the traditional workplace required only rudimentary literacy and numeracy skills among entry-level workers. Until now, this situation has characterize the vast majority of positions open to workers who lack college-level education. However, the Commission argued that the "high-performance" workplace of the future would make substantially greater demands on workers at all levels, requiring greater capacities for higher-order thinking, communicating, and problem-solving. These claims were echoed by the Secretary's Commission on Achieving Necessary Skills (1992, p. 5–6):

> "A high-performance workplace demands workers who have a solid foundation in the traditional basic academic skills, in the thinking skills necessary to put knowledge to work, and in the personal characteristics that make a worker confident, trustworthy, and responsible....High-performance workplaces also require the ability to manage resources, to work amicably and productively with others, to acquire and use information, to understand and master complex systems, and to work comfortably with a variety of technologies."

So far, only about 5 percent of workplaces are "high-performance," but members of these commissions expect that figure to increase over time. Unfortunately, research to date can only tell us about patterns that have occurred until now, and we will need to speculate about how the situation may change in the future.

Theoretical Challenges to the Human Capital Formulation

Aside from these practical complications, there are at least two theoretical challenges to the human capital formulation which raise doubts about the likely impact of increased academic work on labor market outcomes for non-college-bound youth. Adherents of "screening theory" argue that skills and knowledge acquired through schooling are not the reason more educated persons get better jobs. Instead, education leads to occupational success because employers use it as a signal of a candidates' general ability, and as a sign of perseverance and motivation (Arrow, 1973; Collins, 1979). Following this reasoning, one would not expect more academic work to pay off in the labor market, at a given level of schooling. Employers rarely read transcripts (Bishop, 1985; Rosenbaum, 1989), so they do not know anything about a candidate's record other than whether she/he received a diploma. According to this view, there would be no mechanism by which additional academic courses could pay off for someone who does not obtain further schooling.

Questions for this perspective are raised by studies of the hiring process, which show that employers often assess not only candidates' certification, but their competencies (Bills, 1988, 1992; Rosenbaum and Binder, 1994). A high school diploma often is not considered sufficient indication that a candidate holds the necessary skills. Indeed, today's business executives have complained that high schools are not providing sufficient cognitive or social preparation for work (William T. Grant Foundation, 1988b; O'Neil, 1992). Employers do not inspect high school grades (Bishop, 1989; Rosenbaum, 1989), and they are unlikely to do so because grading standards vary across schools and teachers. However, employers are interested in how well job applicants have mastered the kinds of skills they expect students to have acquired in high school. Since the diploma is not a guarantee, they may rely on interviews, recommendations, and/or tests to provide additional information (Bills, 1988; Rosenbaum and Binder, 1994). Thus, despite the screening hypothesis, there is reason to believe that what students learn in

high school may help in the workplace. Consistent with this argument, Wise (1975) showed that not only do ability and achievement improve the productivity of college graduates, but college experiences contribute directly to these enhanced abilities.

Another theoretical objection comes from social reproduction arguments, such as that proposed by Bowles and Gintis (1976). In their view, what is learned in school has great relevance for the workplace. However, it is not cognitive but non-cognitive capacities that matter, according to this perspective. Bowles and Gintis argued that non-college programs in high school prepare students with personality characteristics such as conformity, obedience, and punctuality, which allow non-college-bound students to fit into the capitalist workplace. Instead of aiding labor market success, additional academic training might *hinder* students on the job market, because it would not foster the attitudes desired by employers.

Subsequent evidence has tended to contradict the reproductionist view. Although non-cognitive skills are related to employment opportunities, the personality characteristics emphasized by Bowles and Gintis do not seem central. Employers appear less concerned with obedience to authority, and more interested in reliability and the ability to get along with co-workers (Commission on the Skills of the American Workforce, 1990). A recent review indicated that employee job performance is positively associated with responsibility, self-initiative, and consistency, rather than with compliance (Cappelli, 1992). An important earlier study found that traits such as "leadership" and "executive ability" exerted significant effects on earnings, whereas factors such as "cooperativeness" and "dependability" were less salient (Mueser, 1979). Another analysis demonstrated that the connection of education to earnings is more closely associated with cognitive than non-cognitive characteristics (Olneck and Bills, 1980). At a minimum, one may conclude that there is enough doubt about the causal chain elaborated by Bowles and Gintis (non-college programs in high school emphasize conformity, which is rewarded on the job) to make it worthwhile to investigate the hypothesis that additional academic courses contribute positively to job success.

These theoretical and practical considerations support a prediction that academic preparation in high school adds to labor market success for youths who do not attend college. However, there are at least four important qualifications to this prediction: (1) the effects are likely to be weakest, and possibly non-linear, at entry level; (2) benefits of academic preparation may increase over time, as knowledge and capacities are utilized in more advanced positions; (3) effects may differ across occupational fields; and (4) effects may differ in the future compared to the past, but information is available only about the past.

Methodological and Statistical Considerations

Estimates of the impact of curriculum on labor market outcomes have mainly relied on a standard human capital equation, with employment, wages, or earnings predicted as a function of schooling, including curricular differences within levels of schooling, and a variety of background conditions (Mincer, 1974). Typically, this equation has been estimated using ordinary least squares (OLS) regression. Beyond these broad similarities, studies of curriculum effects on work outcomes vary methodologically in important ways. These differences are partly a function of data set differences, but also result from differential attention to model complexities which cannot be addressed in the simple OLS framework. These complexities must be kept in mind as the evidence is presented.

Measurement issues. Exposure to academic courses has been indicated in two different ways: as enrollment in particular academic courses, in contrast to not taking the courses; and as membership in an academic track, that is, a college-preparatory program in high school, in contrast to general and/or vocational programs. At first glance, it would appear the first approach is more useful than the second, given our interest in academic course work. Measuring the number of academic courses taken fits the research question. Often, separate indicators have been used for different school subjects, allowing even more precise measurement of curriculum effects.

A disadvantage to this approach is that it does not distinguish among types or levels of courses within academic subjects. This is especially troubling for English and social studies, because in these subjects there is little variation in the number of courses students take, but substantial variation in the levels of courses (Gamoran, 1987a, 1989). For example, although students in all curricular tracks average between three and four years of English, students in an academic program are much more likely to take an honors English class (Gamoran, 1987a). Variation in exposure to math and science is reflected to a much greater degree in the number of courses taken in these subjects, but differences between advanced, regular, and remedial courses are also important. Among the major academic subjects, foreign language study is probably the only one for which variation among students can be almost completely captured by measuring the numbers of courses taken without regard to level.

By using track designations to indicate exposure to academic courses, researchers have addressed the ambiguity about levels of courses within subjects to some extent. On average, academic subject courses in the college track are pitched at a more demanding level than those taken by general- and vocational-track students (Oakes, 1985; Gamoran, 1987a; Page, 1991; Gamoran et al., 1992). Also, surveys in the 1980s indicated that college-track students took two or three more academic courses during their four years of high school than general-track students (Daymont and Rumberger, 1982; Sebring, 1987). Hence, examining differences in labor market outcomes for students from different tracks amounts to assessing the impact of taking two or three additional courses, with these and other courses taken at a higher academic level, on average.

Disadvantages to this measurement strategy include (a) reliance for the most part on student reports of track positions, which often fail to reflect variation in course taking (Campbell, Orth, and Seitz, 1981; Gamoran and Berends, 1987; Berends, 1992); (b) failure to disentangle effects of course taking from other conditions that may be more closely linked to track position than particular course enrollment, such as future plans (Berends, 1992); and (c) possible changes over time in the meaning and content of high school curricular programs, making it difficult to compare studies over time (Moore and Davenport, 1988). Thus, there are advantages and disadvantages to both measurement strategies, and it is clearly worth considering results obtained with each.

Another measurement issue concerns the incorporation of an indicator of cognitive skills in the analysis of curriculum and job success. Because students who are more able prior to high school take more academic courses, and because ability is correlated with job success, it is important to control for cognitive ability prior to high school in assessing the effects of academic courses taken in high school on work outcomes after high school.

Because of data set limitations, several studies have controlled for ability at the end of high school in assessing the impact of course taking. While this approach accounts for the differential enrollment of more and less able students in academic courses, it raises other problems. The human capital formulation described above indicates that growth in cognitive capacities is a major mechanism through which course taking effects are likely to operate. If this view is correct, then

the benefits of academic course work occur by raising levels of cognitive skills, and estimates of course work effects should diminish when skills subsequent to course taking are included in the model. Indeed, assuming reliable tests, there is little reason to expect an effect of academic courses once test scores subsequent to course taking are controlled; by controlling for test scores at the end of high school, the effects of academic course taking are probably missed. As we assess the results of different studies, it is essential to bear in mind whether and how cognitive skills were incorporated into the analyses.

Selection issues. Even with controls for cognitive ability, OLS regression may not yield unbiased estimates of course work effects, because of unmeasured differences among students who take different amounts of academic courses. First, the tests used to control for ability are not perfectly reliable, so there may be aspects of ability that are not tapped by the tests which nonetheless affect both course taking and job success. Second, there may be other differences among individuals that lead to both more academic courses and better work outcomes, such as perseverance and motivation. Both of these sources of bias could lead to overestimates of positive effects of academic course work on labor market outcomes.

At the same time, other factors may lead to biases in the opposite direction. A large majority of students who take a heavy load of academic courses go on to postsecondary schooling (Alexander and Cook, 1982; Vanfossen, Jones, and Spade, 1987). Students who take many academic courses, but do *not* enter college, may have characteristics that make them *less* likely to do well on the job market. They may have taken many courses, but performed very poorly. They may be prone to daydreaming. They may have especially unrealistic views about their own capabilities, or they may have drifted through high school without a clear sense of direction (Powell, Farrar, and Cohen, 1985). In the absence of evidence, all this is speculation, but it is clearly reason enough for interpreting estimates with great caution. With work success as the outcome, selection problems are even more complex than in OLS analyses of tracking and achievement (e.g., Gamoran, 1987a; Natriello, Pallas, and Alexander, 1989): In research on tracking, the direction of the bias is well understood, even when there is uncertainty about its strength (Gamoran and Mare, 1989). In the present context, even the direction of selection bias is unknown.

Another way of looking at this problem begins with the decision by many analysts to restrict their samples to youths who do not attend college, as a way of focusing on outcomes for that group. It is likely that the students who benefitted most from their academic courses did proceed to college, and are thus not included in the analyses. Students remaining in the sample who took more than the average number of academic courses may be negatively selected for gains from these courses. They may have profited even less than students who took fewer academic courses would have, had they enrolled. Hence, predictions about potential benefits of increasing academic course-taking among non-college-bound students may well be flawed by selection problems.

Analyses of course enrollment generally assume that course taking effects subsequent outcomes, whether at work or school. In reality, however, course enrollment and subsequent experiences are probably jointly determined, at least to some degree. That is, decisions about what courses to take may occur in combination with decisions about one's likely activities after high school (Gamoran and Mare, 1989). On the one hand, this may inflate estimates of academic course-taking effects: Those who foresee a high payoff to such courses are more likely to enroll, while those who do not expect to benefit refrain, and in that case OLS estimates of the benefits of academic course work would be biased upward, because effects are only observed for those who expect to gain. On the other hand, joint determination of course-taking and postsecondary outcomes may lead to underes-

timates of effects on labor market outcomes, under a different scenario: Students who are highly motivated towards immediate earnings after high school may take the minimum number of academic courses during high school, yet be successful in pursuing a job. In this case, the benefits of academic courses for the average student may be obscured by the labor market success of these earnings-oriented students.

A final selection issue arises because studies differ in the way they treat respondents who are unemployed. By excluding them or by counting their wages as zero—the two most common approaches—researchers may distort estimates of curriculum effects on wages. This is because factors that lead to employment (versus unemployment) may differ from conditions that lead to higher or lower wages. A few studies have used econometric techniques to consider labor force participation and wages simultaneously, and these should be given substantial weight in our review.

Other specification issues. Theoretical considerations led us to anticipate possible non-linear effects of academic course-work on job success. This can be incorporated into an OLS framework, although most studies do not do so. We also predicted that effects may increase for individuals over time. This may be addressed by comparing studies that consider effects at different career points. Also, a few studies report effects for individuals at more than a one-time point.

Most analyses provide estimates of the effects of academic programs or courses, with other conditions held constant. Yet if academic course work is to increase, one may ask, what would it replace? Thus, it is worth noting not only the effects of academic courses, but effects of the alternatives—for example, vocational courses. It is also possible, however, that academic courses could increase modestly among non-college-bound students without sacrificing courses in other areas. This is evident because non-college students currently take fewer courses and acquire fewer credits overall, compared with college-preparatory students (Daymont and Rumberger, 1984). The most thorough way of addressing this issue is to evaluate the impact of combinations of courses, and a few studies have taken this approach.

Direct Evidence on the Impact of Academic Courses

With these considerations in mind, we are prepared to assess the evidence. Seven data sets have been used in a dozen separate studies to provide information that is directly relevant to the question at hand. The data sets are:

(1) Educational Testing Service (ETS) data collected from high school sophomores in 1955 and followed up in 1970 (Griffin and Alexander, 1978);

(2) The U.S. Department of Labor's National Longitudinal Survey of Labor Market Experiences (NLS-LME), begun in 1966 with males aged 14–24, with annual follow-ups through 1973, and with a comparable sample of females followed from 1968 to 1972 (Grasso and Shea, 1979);

(3) A subset of the NLS-LME, consisting of respondents who were 17 years old in 1968 (Gustman and Steinmeier, 1979);

(4) The National Longitudinal Study of the High School Class of 1972 (NLS-72), a U.S. Department of Education survey of high school seniors in 1972 with follow-ups in 1976 and 1986 (Gustman and Steinmeier, 1979; Meyer, 1982; Altonji, 1992; Hollenbeck, 1993);

(5) The New Youth Cohort of another National Longitudinal Survey (NLS-Y), with data from respondents aged 14–21 in 1979 and followed through 1982 (Daymont and Rumberger, 1982; Gardner, 1984);

(6) The 1980 Senior Cohort from High School and Beyond (HSB), another U.S. Department of Education national longitudinal educational survey, with a 1980 base year survey of high school seniors, and follow-ups in 1982 and 1984 (Kang, 1984; Kang and Bishop, 1986, 1989); and

(7) The 1980 Sophomore Cohort from HSB, with a 1980 base year survey of high school sophomores, and follow-ups in 1982 and 1984 (Hotchkiss and Dorsten, 1987).

All seven data sets are nationally representative of their target populations. Most followed students for no more than six years after high school; however, the ETS data and the NLS-72 followed students for considerably longer. The twelve studies in which the data sets were analyzed differed in their model specifications, even among studies that used the same data set. The most important differences include whether they used controls for cognitive ability, and if so, from what point in time; whether educational attainment was taken into account, and if so, through a sampling restriction, or by statistical controls in the regression model; whether they used a method other than OLS regression to address selection issues; and whether the main predictor variable reflects academic courses or an overall academic program. The twelve studies examined many types of labor market outcomes, but only four outcomes were considered in more than one study, and I will concentrate on them. The four outcomes are: (1) hourly wages; (2) weeks or months employed in a given time frame; (3) annual earnings; and (4) attainment of occupational status.

Effects on Hourly Wages

Eight studies examined effects of academic coursework on hourly wages. Their findings are summarized in table 1.

Studies with controls for test scores prior to coursework. The studies that best match our theoretical specification are those that control for cognitive skills prior to high school (to take into account differential propensities to enroll in academic courses), but not after high school (to avoid masking the effects of course work that occur through gains in skills). Four studies followed this design, and these indicate a small, inconsistent relation between coursework and wages for men, and a modest tendency towards positive effects for women, with some contrary findings. None of the estimates for men were statistically significant in the original studies, and as many were negative as were positive. Hotchkiss and Dorsten (1987) did not distinguish between effects for men and effects for women, and they found effects close to zero.

Both Grasso and Shea (1979), using NLS-LME, and Daymont and Rumberger (1982), using NLS-Y from a decade later, found that women who engaged in more academic study obtained higher wages in the first few years after high school. Grasso and Shea reported a substantial gain of nearly 10 percent for women who had enrolled in a college-preparatory program, compared to those in the general track. Daymont and Rumberger observed a gain of just over 1 percent for each academic credit. At first glance, this appears a much smaller impact than that observed by Grasso and Shea, since college-preparatory students take only two to three more academic courses during their four years of high school than general-track students. However, the effect of college-

Table 1.—Effects of academic programs and courses on hourly wages

STUDY	DATA SET AND YEARS	SUBGROUP OR METHOD	ACADEMIC TRACK OR COURSE	PERCENTAGE CHANGE IN WAGES[a]	ED. SAMPLE RESTRICTIONS OR CONTROLS	TIME LAG AFTER HIGH SCHOOL
			Studies with no controls for cognitive skills			
Altonji (1992)	NLS-72 1972–86	OLS	Academic courses, average of 5 subjects	0.6[b]	Controls for educational attainment	Average over 5–14 years
		Instrumental Variables (IV)	Academic courses, average of 5 subjects	-0.2[c]		
		IV	Academic qacourses, controlling for track	-0.2		
		IV	Academic track, controlling for courses	2.6		
			Studies with controls for cognitive skills prior to high school course work			
Grasso and Shea (1979)	NLS-LME 1966–73	white males	College track	-3.7	12 years of schooling exactly	1–5 years
	1968–72	white females	College track	9.8[d]		1–4 years
Daymont and Rumberger (1982)	NLS-Y 1979–80	males	Academic credits	0.7	12 years schooling at most	1–4 years
		females	Academic credits	1.1[d]		
Gardner (1984)	NLS-Y 1979–82	white males	College track	3.5	High school graduates employed full time	1–6 years
		minority males	College track	-4.3		
		white females	College track	-2.9		
		minority females	College track	-11.5		
Hotchkiss and Dorsten (1987)	HSB Sophomores 1980–84	OLS	Academic concentration	0.0	No controls for ed. attainment	2 years
		corrected for labor force partic	Academic concentration	0.2		

Table 1.—Effects of academic programs and courses on hourly wages—Continued

STUDY	DATA SET AND YEARS	SUBGROUP OR METHOD	ACADEMIC TRACK OR COURSE	PERCENTAGE CHANGE IN WAGES[a]	ED. SAMPLE RESTRICTIONS OR CONTROLS	TIME LAG AFTER HIGH SCHOOL
			Studies with controls for cognitive skills after high school course work			
Kang and Bishop (1986)	HSB Seniors 1980–82	males females	Academic courses, average of 5 subjects	-0.0 -1.0	No full-time schooling after high school	2 years
Kang and Bishop (1989)	HSB Seniors 1980–82	males females	Academic courses	-0.2 -0.9[d]	No full-time schooling after high school	2 years
Altonji (1992)	NLS-72 1972–86	OLS Instrumental Variables	Academic courses, average of 5 subjects Academic courses, average of 5 subjects	0.1 -0.1[f]	Controls for educational attainment	Average over 5–14 years
Hollenbeck (1993)	NLS-72 1972–86	males females males females	College track College track College track College track	-2.8 -0.2 -13.0[d] 14.8[d]	Controls for ed. attainment No postsecond. schooling	14 years

NOTES:

[a]Percentage change in hourly wages from each additional academic course or from membership in an academic rather than a general high school program, as indicated. Percentages were computed from regression coefficients on log hourly earnings, except in the cases of Grasso and Shea (1979) and Kang and Bishop (1986, 1989), who reported effects on hourly earnings in dollars; in these cases, percentages were computed by dividing regression coefficients by mean hourly wages of the appropriate subgroup. Effects were estimated using OLS regression unless otherwise indicated.

[b]Regression coefficients for foreign language (+.012) and math (+.018) were more than twice their standard errors.

[c]Regression coefficient for foreign language (+.023) was more than twice its standard error.

[d]Regression coefficient on which the percentage is based was more than twice its standard error.

[e]Regression coefficient for history/social studies (-.192) was more than twice its standard error.

[f]Regression coefficient for foreign language (+.028) was more than twice its standard error.

track membership reflects differences in *levels* as well as varied numbers of courses. Hence, these two studies suggest that an academic program of study is beneficial for the wages of young women who do not go on to college.

However, Gardner (1984), using the same data set as Daymont and Rumberger (1982) and following respondents for two years longer, obtained non-significant negative coefficients for white and minority females. This result is especially surprising since Gardner's estimates reflect participation in an academic program of study consisting of at least four years of English, three years of math, and two of science and social studies. Still, a number of other design differences could account for the varying results. First, while Daymont and Rumberger used ninth grade GPA to control for cognitive skills, Gardner used an ability test. On the one hand, the test is undoubtedly a more reliable control, and Daymont and Rumberger's finding could thus be overstated. On the other hand, Daymont and Rumberger explained that the reason they did not use this variable is that it was missing for about half the cases. Moreover, survey respondents who were out of high school at the time of the survey (half the sample or more) would have taken the test after completing their high school course work, and this would tend to obscure the impact of academic courses if the impact occurs by adding to cognitive skills. Finally, Gardner included only respondents who were employed full time; this could have eliminated an important source of variation in wages. These problems raise doubt about Gardner's findings, and suggest we should not use them to overturn Grasso and Shea's and Daymont and Rumberger's conclusions.

Other studies. Altonji (1992), analyzing NLS-72, recognized the problem of controlling for ability at the end of high school, but the survey began with high school seniors and did not obtain earlier test scores. Consequently, Altonji reported results with and without the test score controls. Without these controls, Altonji found coefficients of .018, .003, -.001, -.002, and .012, for math, science, English, social studies, and foreign language courses, respectively. These average to .006, or an increase of 0.6 percent for each additional course (see Jencks et al., 1979, p. 27–28, for a clear exposition of transforming logarithmic coefficients to percentages).

To adjust for selection bias in this model, Altonji used between-school variation in course taking as an instrumental variable to identify the effects of individual students' course work. This approach assumes that some schools induce students to take more academic courses, increasing students' enrollment propensities apart from individual background and test score differences. Using this method, Altonji found even smaller effects of course work on wages, although the effect for foreign language remained positive and statistically significant. Noting the negative coefficients for English and social studies, Altonji estimated the impact of taking an additional year each of math, science, and foreign language. This analysis indicated benefits of over 3 percent using OLS, but less than 2 percent using the instrumental variables approach. In another model, Altonji included a control for curricular track; this analysis yielded similar estimates for course work effects, and a non-significant impact of 2.6 percent for college-track membership.

Overall, Altonji's work suggests the impact of academic courses on wages is small, but (most clearly in the case of foreign language) probably non-zero. This finding covers the period from 5 to 14 years after high school, and it is averaged across persons with different years of schooling, controlling for educational attainment. In results not displayed in tables, Altonji noted that the positive effects of foreign language courses were stronger for those who did not attend college than for those who did. Unfortunately, Altonji did not distinguish between effects for men and effects for women.

Altonji's study, like others that examine courses or credits, lacks information on the type or level of courses within subject areas. A likely reason for stronger effects of math, science, and especially foreign language is that they represent an academic focus involving higher level courses; as noted earlier, students vary little in the number of courses they take in English and social studies, even though they often differ in course levels. Altonji attempted to take course levels into account with additional, separate analyses of students in academic and non-academic tracks, with similarly weak results. This sampling partition confounds differences among students with differences among courses—there is much overlap in self-reported track membership among students in different courses—so it is not surprising that the results did not change much.

Of analyses that controlled for ability using tests administered at the end of high school, most observed negative coefficients for the link between academic courses and wages. Both studies by Kang and Bishop (1986, 1989) found negative effects on wages two years after high school. Hollenbeck found a substantial negative effect for men 14 years after high school but an even larger positive effect for women, comparing those enrolled in the college track with those in the general track during high school.

It is difficult to interpret the coefficients for academic courses and programs in these analyses. If academic course work contributes to wages, it must do so by affecting cognitive skills; at least, no other mechanism has been suggested. Hence, one would expect zero effects in these models. Negative effects could come from selection patterns described earlier; for example, students who took many academic courses, but who did not go to college may be those who benefit least from such courses. Another consideration for the Kang and Bishop studies is that outcomes were measured only two years after high school; perhaps not enough time had passed for the benefits of courses to be reflected in wages.

Time-varying effects, non-linearities, and tradeoffs. Two studies attempted to model changes in effects for individuals over time. Grasso and Shea (1979) observed that for men, the benefits of a college-preparatory curriculum increased with work experience among those who did not attend college. However, a separate analysis of growth in wages indicated no significant curriculum effects, so the authors interpreted the first finding as reflecting a period effect; that is, the college track may have had increasing benefits across the cohorts included in the NLS-LME, who ranged from 14 to 24 years of age in 1966. Analyzing a single cohort, Kang (1984) also found no significant differences in the growth of hourly wages among persons with varied academic training in high school, during the first 21 months after high school completion. However, Altonji (1992) reported steeper growth in wages for students who completed more course work in science and foreign language; results for math, English, and social studies were small and statistically insignificant.

Kang and Bishop (1989) allowed for a non-linear effect of course work by including a quadratic term in their regression equations. They found no accelerating or decelerating effects on hourly wages. However, they observed a positive interaction of academic and vocational courses for males, which they interpreted as an indication that academic courses enhance the effects of vocational courses. These models are provocative, and would be worth replicating in analyses that control for test scores prior to course work.

Summary of effects on wages. The best available evidence suggests that academic courses in high school provide small benefits to wages in the first few years after high school. This conclusion holds more securely for women than men, because separate analyses yielded non-significant and sometimes negative results for men. These effects may have increased during the 1960s and

early 1970s, and they may increase for an individual over time, although the evidence supporting that prediction is inconsistent. Analyses of separate academic subjects show the strongest effects for foreign language; assuming this is not merely selection bias, it may mean that such courses promote communication skills and general cognitive abilities that pay off at work (Altonji, 1992), or it may reflect enrollment in high-level academic courses, with which foreign-language enrollment is correlated (Rosenbaum, 1976; Alexander and Cook, 1982).

Effects on Employment

Three studies with controls for prior achievement examined the impact of exposure to academic curricula on employment shortly after high school. Daymont and Rumberger (1982) found that the more academic credits students had accumulated, the less likely they were to be unemployed after high school. (To simplify presentation, I have reversed the sign of the effect on unemployment for display in table 2, which lists effects on weeks employed.) Accumulating vocational credits also aided employment opportunities in Daymont and Rumberger's analyses, so the main contrast is with studies in art, music, physical education, etc., and more importantly, with obtaining fewer credits overall during high school.

Gustman and Steinmeier (1982) obtained a positive coefficient on weeks employed for males, but a negative coefficient for females, and neither was statistically significant. Sample sizes in these analyses of NLS-LME were very small—only 83 males and 52 females—which could account for the imprecision of the estimates. Hotchkiss and Dorsten's (1987) observation of essentially no relation between a concentration in academic course work and employment undoubtedly reflects their sample, which included students currently enrolled in post-secondary education, the destination for most students who focused on academic studies in high school. Hotchkiss and Dorsten also reported that more concentration in academic courses reduced the likelihood of unemployment shortly after high school. Again, however, the contrast was mainly with attending postsecondary schooling rather than with participation in the labor force.

Gustman and Steinmeier had much larger samples in their analyses of NLS-72, but unfortunately these data lack information on cognitive skills prior to high school, and by including subsequent test scores, effects of academic courses may have been obscured. The same must be said of Meyer's (1982) otherwise useful model which examines effects on weeks worked during the first, fourth, and seventh calendar years after high school. Kang and Bishop's (1986, 1989) analyses of HSB Seniors also adjust for skills at the end of high school, and although they find no sign of direct benefits of academic course work, I will argue subsequently (in considering indirect effects of course work) that their results provide evidence that academic studies contribute positively to employment by improving cognitive skills.

In sum, only one study employed a model that meets the theoretical requirements outlined earlier, with a sample of adequate size (Daymont and Rumberger, 1982). This study suggests that students who take more academic courses are less likely to be unemployed after high school.

Effects on Annual Earnings

Analyses of annual earnings yield the most inconsistent and intractable results among the four outcomes we are considering. Four studies considered the impact of an academic program on annual earnings using controls for test scores prior to course enrollment (see table 3). Three obtained positive coefficients of non-trivial sizes for men (Grasso and Shea, 1979; Gustman and

Table 2.—Effects of academic programs and courses on employment

STUDY	DATA SET AND YEARS	SUBGROUP OR METHOD	ACADEMIC TRACK OR COURSE	EFFECTS ON WEEKS/MOS. WORKED[a]	ED. SAMPLE RESTRICTIONS OR CONTROLS	TIME LAG AFTER HIGH SCHOOL
			Studies with controls for cognitive skills prior to high school course work			
Gustman and Steinmeier (1982)	NLS-LME class of 1969	white males	College track	2.54	High school graduation only	3 years
		white females	College track	-0.87		
Daymont and Rumberger (1982)	NLS-Y 1979–80	males	Academic credits	0.575[b]	12 years schooling at most	1–4 years
		females	Academic credits	0.435[b]		
Hotchkiss and Dortsen (1987)	HSB Sophomores 1980–84		Academic concentration	-0.0328	No controls for ed. attainment	2 years
			Studies with controls for cognitive skills after to high school course work			
Gustman and Steinmeier (1982)	NLS-72 1972–76	white males	College track	-0.95		
		black males	College track	-4.14	High school graduation only	4 years
		white females	College track	0.76		
		black females	College track	-3.19		
Meyer (1982)	NLS-72 1972–79	males	Academic program	1.0295		1 year
			Academic program	-0.4038		4 years
			Academic program	0.7055	12 years of schooling exactly	7 years
		females	Academic program	0.8965		1 year
			Academic program	0.6414		4 years
			Academic program	0.8616		7 years

Table 2.—Effects of academic programs and courses on employment—Continued

STUDY	DATA SET AND YEARS	SUBGROUP OR METHOD	ACADEMIC TRACK OR COURSE	EFFECT ON WEEKS/MO. WORKED[a]	ED. SAMPLE RESTRICTIONS OR CONTROLS	TIME LAG AFTER HIGH SCHOOL
Studies with controls for cognitive skills after high school course work (continued)						
Kang and Bishop (1986)	HSB Seniors 1980–82	males females	Academic courses, average of 5 subjects	-0.033 -0.162	No full-time schooling after high school	2 years
Kang and Bishop (1989)	HSB Seniors 1980–82	males females	Academic courses	-0.101 -0.320[b]	No full-time schooling after high school	2 years

NOTES:

[a] Coefficients indicate effects on weeks worked per year, with the following exceptions: for Daymont and Rumberger (1982), the dependent variable was weeks unemployed, and I have reversed the sign of the coefficient; for Hotchkiss and Dorsten (1987), effects are for weeks worked during the first 21 months after high school, and for Kang and Bishop (1986, 1989), coefficients represent effects on months worked during the first 21 months after high school. All analyses used OLS regression.

[b] Coefficient was more than twice its standard error.

Table 3.—Effects of academic programs and courses on annual earnings

STUDY	DATA SET AND YEARS	SUBGROUP OR METHOD	ACADEMIC TRACK OR COURSE	PERCENTAGE CHANGE IN EARNINGS[a]	ED. SAMPLE RESTRICTIONS OR CONTROLS	TIME LAG AFTER HIGH SCHOOL
			Studies with controls for cognitive skills prior to high school course work			
Griffin and Alexander (1978)	ETS 1955–1970	males	College track	-22.1[b]	High school graduation only	13 years
			Math/science courses	0.8		
Grasso and Shea (1979)	NLS-LME 1966–73	white males	College track	7.9	12 years of schooling exactly	1–4 years
	1968–72	white females	College track	5.4		2–3 years
Gustman and Steinmeier (1982)	NLS-LME class of 1969	white males	College track	8.8	High school graduation only	3 years
		white females	College track	-12.3		
Gardner (1984)	NLS-Y 1979–82	white males	Academic program	3.0	High school graduates employed full time	1–6 years
		minority males	Academic program	-6.6		
		white females	Academic program	-2.7		
		minority females	Academic program	-8.3		
			Studies with controls for cognitive skills after high school course work			
Gustman and Steinmeier (1982)	NLS-72 1972–76	white males	College track	2.8	High school graduation only	4 years
		black males	College track	-6.3		
		white females	College track	6.1		
		black females	College track	-4.1		
Kang and Bishop (1986)	HSB Seniors 1980–82	males	Academic courses, average of 5 subjects	-1.1	No full-time schooling after high school	1 year
		females		-3.2[c]		

Table 3.—Effects of academic programs and courses on annual earnings—Continued

STUDY	DATA SET AND YEARS	SUBGROUP OR METHOD	ACADEMIC TRACK OR COURSE	PERCENTAGE CHANGE IN EARNINGS[a]	ED. SAMPLE RESTRICTIONS OR CONTROLS	TIME LAG AFTER HIGH SCHOOL
Studies with controls for cognitive skills after high school course work (continued)						
Kang and Bishop (1989)	HSB Seniors 1980–82	males females	Academic courses	-0.4 -5.1[b]	No full-time schooling after high school	1 year
Hollenbeck (1993)	NLS-72 1972–86	males females	College track College track	6.0[b] 13.0[b]	Controls for ed. attainment	14 years

NOTES

[a] Percentage change in annual earnings from each additional academic course or from membership in an academic rather than a general high school program, as indicated. Percentages were computed by dividing effects on annual earnings by average annual earnings, with the following exceptions: figures for Gardner (1984) are percentage changes in **monthly** earnings, based on regressions on log monthly earnings; figures for Hollenbeck (1993) are derived from regressions on log monthly earnings; and percentage changes in annual earnings from Gustman and Steinmeier (1982) were computed as the impact on usual weekly earnings multiplied by the average number of weeks employed for academic-track students, divided by the average usual weekly earnings multiplied by average weeks employed among general-track students. Effects were estimated using OLS regression unless otherwise indicated.

[b] Regression coefficient on which the percentage is based was more than twice its standard error.

[c] Regression coefficient for history/social studies (-.358) was more than twice its standard error.

Steinmeier, 1982; and Gardner, 1984). However, using an older and earlier sample, Griffen and Alexander (1978) found that earnings for college-track males were substantially lower than those of other students, among those who did not attend college. The authors were puzzled by this finding and, in a footnote, pointed out its consistency with Bowles and Gintis' (1976) view that attitudes learned in the college track are not well suited to jobs of non-college men. The result may also be an artifact of selection, in that college-track students who did not go on to college may have had characteristics that made them poorly suited for work as well as further schooling; this may have been more true in the past when curricular tracks defined students' programs more rigidly than at present (Moore and Davenport, 1988).

In light of problems noted above with analyses by Gustman and Steinmeier (1982) and Gardner (1984), one may have the most confidence in Grasso and Shea's (1979) results. Although they reported positive coefficients, the results were not reliably different from zero for males or females. Without offering specific coefficients, Olneck (1979) also reported that two national surveys from the 1960s indicated that completing a college-preparatory curriculum in high school had no impact on earnings for men who attained the same levels of schooling.

Studies that controlled for test scores after high school show the familiar pattern of zero or negative effects, with the notable exception of Hollenbeck (1993). In his analyses of NLS-72, academic-track males and especially females earned substantially more 14 years after high school, compared with students of similar ability from the general track.

Based on research summarized above suggesting small positive effects on both wages and on employment, one would have expected to see benefits for annual earnings. Yet the evidence does not support this expectation.

Effects on Occupational Status

In contrast to effects on annual earnings, effects on occupational status are more consistent and yield to straightforward interpretation. All three studies listed in Table 4 show some sign of positive effects of participation in academic study on occupational status, and results in two of the three were statistically significant. Both Griffin and Alexander (1978) and Grasso and Shea (1979) conducted separate analyses of high school graduates who did not attend college (among other subsamples). Griffin and Alexander observed a non-significant negative coefficient for college-track membership, but a significant positive effect for enrollment in math and science courses. Each additional course contributed about eight-tenths of a point on a scale of approximately 100 points. Students who took three years of math and science would end up about two and a half points higher than students who took only one year of each [(6 - 2) x .811 = 2.444]. This is a small impact, considering that 13 years had passed since high school graduation. Grasso and Shea found male academic-track students about the same amount ahead of their non-academic peers, but the difference was not statistically significant, and the effect for females was close to zero.

Hotchkiss and Dorsten (1987) did not restrict their sample to persons who stopped their schooling after high school. Hence, their finding of an advantage of a third of a point for students who concentrated on academic courses in high school could reflect differences among students in the propensity to acquire further schooling. In a second analysis, however, the authors introduced an adjustment for the propensity to enter the labor force. This correction takes into account differential likelihood of continuing in school, and it produced a similar result for the impact of academic studies on occupational status.

Table 4.—Effects of academic programs and courses on occupational attainment

STUDY	DATA SET AND YEARS	SUBGROUP OR METHOD	ACADEMIC TRACK OR COURSE	EFFECT ON OCCUPAT. ATTAINM'T[a]	ED. SAMPLE RESTRICTIONS OR CONTROLS	TIME LAG AFTER HIGH SCHOOL
			Studies with controls for cognitive skills prior to high school course work			
Griffin and Alexander (1978)	ETS 1955–70	males	College track Math/science courses	-3.13 0.811[b]	High school graduation only	13 years
Grasso and Shea (1979)	NLS-LME 1966–73	white males	College track	2.54	12 years schooling exactly	1–5 years
	1968–72	white females	College track	-0.03		1–4 years
Hotchkiss and Dorsten (1987)	HSB Sophomores 1980–84	OLS	Academic concentration	0.3136[b]	No controls for ed. attainment	2 years
		corrected for labor force partic	Academic concentration	0.3335[b]		

NOTES:

[a] Coefficients are effects on Duncan SEI points; for females, Grasso and Shea (1979) used the Bose scale (a similar scale). All estimates are from OLS regressions.

[b] Coefficient was more than twice its standard error.

These studies suggest that students who take more academic courses in high school find jobs with higher status soon after high school. Although this effect is not reflected in wages or earnings at entry level, it may yield greater benefits over time.

Indirect Evidence: Effects of Academic Skills

Our underlying conceptual model suggested that academic courses contribute to work outcomes by improving cognitive skills, which in turn add to labor market success. In addition to considering overall effects of course work, it is appropriate to examine the separate links of this hypothetical causal chain. Does course work affect cognitive skills, and do cognitive skills contribute to labor market opportunities? Evidence of strong links would add support to the tentative conclusion that academic course work contributes modestly to labor market outcomes.

Studies of Coursetaking and Cognitive Achievement

Since the 1980s, a variety of studies have provided consistent evidence that students who enroll in more academic courses score higher on tests of cognitive achievement. Studies of math enrollment in the early 1980s, using data from NLS-72 (Welch, Anderson, and Harris, 1982), HSB (Walberg and Shanahan, 1983), and the National Assessment of Educational Progress (Schmidt, 1983) showed substantial achievement benefits for each additional math course. These estimates, it turned out, were inflated by the absence of a control for prior math achievement. Still, later studies that took prior achievement into account sustained the earlier conclusions: students who enrolled in more math courses in high school gained more knowledge and skills (Alexander and Pallas, 1984; Moore and Smith, 1985; Jones et al., 1986; Gamoran, 1987a; Sebring, 1987; Ekstrom, Goertz, and Rock, 1988; Lee and Bryk, 1988; Meyer, 1992). Several studies observed that higher-level courses (i.e., geometry, algebra 2, trigonometry, calculus) contributed more than lower-level math courses, but after correcting for measurement error in an achievement test, Meyer (1992) showed that pre-algebra and algebra 1 also bring substantial benefits. A number of studies also provided evidence of curriculum effects on achievement in science, English, social studies, and/or foreign languages (Welch, Anderson, and Harris, 1982; Walberg and Shanahan, 1983; Alexander and Pallas, 1984; Jones et al., 1986; Gamoran, 1987a; Sebring, 1987). Generally, the strongest effects have been observed in math. Gamoran (1987a) noted that whereas differences in the number of English courses did not affect reading or vocabulary achievement (presumably because students vary little on this measure), enrolling in an honors English course contributed to achievement. He interpreted this finding to indicate that higher-level English courses contribute more to achievement than lower-level courses.

Studies of Cognitive Achievement and Labor Market Outcomes

Overall, cognitive skills contribute substantially to job success, but most of this effect runs through educational attainment. Still, net of schooling, research with several national and regional surveys has shown consistent effects of general cognitive ability on wages and earnings. Crouse (1979) reported analyses of five large surveys, of which four showed positive and significant effects on earnings, with gains as high as fourteen percent for a standard deviation increase in test scores among men aged 35 to 59 with the same amount of schooling.

Generally, the benefits of cognitive skills for earnings increase with age. More recent analyses have continued to exhibit notable ties between ability and wages or earnings (e.g., Blackburn and Neumark, 1993; Cameron and Heckman, 1993). A few exceptions can be found (Griffin and Alexander, 1978; Hollenbeck, 1993), but the bulk of the research clearly indicates a positive connection between test scores and long-term work outcomes, even among persons with the same amount of schooling.

Having examined numerous types of ability tests, research in personnel psychology concluded that general cognitive ability is the strongest predictor of job performance (e.g., Hunter and Hunter, 1984). This is consistent with research on the SCANS tests and the work force, which indicates that foundation skills of basic literacy and numeracy, communication, problem-solving, and an ability to work responsibly and with others, matter more for job performance than competencies more oriented to the workplace (Cappelli and Rogovsky, 1993a, 1993b). Studies of test scores and earnings have not examined as wide a wide range of tests, mainly relying on quantitative, verbal, and general cognitive skills tests. Taubman and Wales (1975) found that math ability was linked to earnings, but verbal ability, coordination, and spacial perception were not. Two recent studies observed that for males, quantitative skills are more closely tied than verbal scores to both employment (Rivera-Batiz, 1992) and wages (Murnane, Willett, and Levy, 1993). For females, higher verbal and math scores appeared to enhance employment opportunities (Rivera-Batiz, 1992). Yet another research team found that for males, vocabulary achievement mattered more than math scores for employment, whereas math was more salient for females (Kang and Bishop, 1986). Inconsistencies in the relative salience of math and verbal skills across studies may indicate that an underlying set of general cognitive skills, with which scores in all these realms are correlated, contributes to employment outcomes. General cognitive ability may still be enhanced by academic course work, as indicated by studies of course taking and achievement.

Effects on earnings and wages among young workers. The claim that higher test scores improve labor market outcomes has one very important caveat: Effects on wages and earnings are weak or even non-existent immediately after high school, for those who do not pursue further schooling. Bishop (1985, 1988, 1989, 1993) has shown in a series of reviews and analyses that few benefits of cognitive ability are evident for young men and women. Most estimates for 19-year-olds are close to zero (Hause, 1975; Meyer, 1982; Bishop, 1985, 1989; Kang and Bishop, 1986). Effects for persons in their early twenties are small, but generally non-zero. Taggart, Sum, and Berlin (1987) provide a useful metric for understanding this effect: among 19- to 23-year-olds, one more grade-level equivalent in basic skills was worth 3.6 percent in earnings, or $185 for the year in 1981, whereas one additional grade of schooling completed was worth $715, and a high school diploma was worth $927, net of attainment. Although one study found zero or even negative effects for males as far as ten years out of high school (Bishop, 1993), most research has observed small to moderate positive effects on wages and/or earnings, for men as well as women in their mid- to late twenties (Crouse, 1979; Meyer, 1982; Meyer and Wise, 1982; Cameron and Heckman, 1993; Murnane, Willett, and Levy, 1993). Estimates in these studies of returns to wages or earnings from an increase of one standard deviation in test scores ranged from 3 percent to about 8 percent for males, and from 4 percent to over 15 percent for females.

Studies that allow for changes over the early career in the effects of cognitive skills have found no growth in the first year or two, but increasing benefits thereafter. In their classic study of educational self-selection, Willis and Rosen (1979) found that for men who did not attend college,

ability tests had no impact on earnings at labor market entry, but the effects of reading ability became increasingly important over a 20 year period. Examining HSB seniors, Kang (1984) reported no initial effects and no growth in the impact of test scores during the first 21 months after high school. In contrast, Meyer (1982) observed that whereas effects of ability on wages were trivial for NLS-72 participants in 1973 (one year after high school), the benefits had increased and were statistically significant by 1979, six years later. Murnane, Willett and Levy (1993) analyzed math skills in both of these data sets, and found similar results: two years after high school, the benefits of high test scores were nil for males and small for females, but six years after high school the benefits were more substantial.

Murnane, Willett, and Levy (1993) also documented increases in the payoff to academic skills for the more recent cohort (1980 high school seniors) as compared with the earlier cohort (1972 seniors). Whereas an increase of about two standard deviations on the math test was worth $0.46 per hour for men and $1.15 per hour for women 6 years out of high school in 1978, the same test-score increase amounted to hourly wage benefits of $1.15 for men and $1.42 for women at the same career stage in 1986 (all in 1988 dollars). These results were obtained with years of schooling held constant. The authors reported no interactions of test scores with educational attainment, consistent with Crouse's (1979) earlier results with several large surveys (but see Hause, 1975, and Blackburn and Neumark, 1993, for evidence of possible schooling-by-ability interactions).

Murnane, Willett, and Levy's (1993) findings may indicate that academic skills are becoming more important in the labor market, as claimed by a number of recent reports (Commission on the Skills of the American Workforce, 1990; Secretary's Commission on Achieving Necessary Skills, 1991, 1992). Although much research has addressed changes in the returns to education (see Levy and Murnane, 1992, for a review), the work of Murnane, Willett, and Levy is the first to consider historical changes in the impact of cognitive skills using equivalent test instruments and identical statistical models; this despite the fact that Crouse (1979) had decried the lack of historical analyses of ability and earnings more than a decade ago.

Effects of test scores on employment. While test scores bear little immediate impact on wages, that is not the case for employment opportunities. Indeed, basic skills may have their strongest impact at labor market entry. Cameron and Heckman (1993) reported larger effects on annual hours worked for men at age 25 than at age 28. Similarly, Meyer and Wise (1983) found that the benefits of high test scores for men's employment were greater in the first three years out of high school than in the subsequent two years. Both of these studies are exemplary, in that they provided statistical adjustments for selection into the labor force (as opposed to schooling). Also, Meyer and Wise used a statistical model that takes into account the lower and upper truncation on weeks worked in a year. The trend of larger effects on employment at labor market entry may pertain more to men than to women: Meyer (1982) also observed this pattern for men, but for women he found that test scores exerted stronger effects at age 25 than at age 19. Neither Meyer and Wise (1982) nor Cameron and Heckman (1993) included women in their analyses. Kang (1984) observed significant and steady positive effects of test scores on hours worked during the first 21 months out of high school, for both males and females.

Qualitative studies of the employment process support the conclusion from survey research that stronger basic skills enable high school graduates to find jobs, even if they do not obtain higher wages. Testimony cited by the William T. Grant Foundation (1988b) indicates that employers are reluctant to hire persons with weak skills. One business executive explained: "We do not employ

people who do not have the basic skills because they are not able to benefit from the training we offer, and they are dangerous to themselves and to others in the workplace" (p. 93). In a more systematic investigation, twenty out of thirty employers interviewed by Rosenbaum and Binder (1994) stated that a lack of basic skills makes some high school graduates unsuitable for entry-level jobs in their firms. Employers who were not concerned with basic skills were generally those who anticipated large turnover or little advancement among entry-level employees.

Indirect Effects of Coursework via Cognitive Achievement

No study has specifically measured the indirect effects of academic programs or courses on labor market outcomes via growth in academic skills. By juxtaposing studies of course work and achievement on the one hand, and studies of achievement and job success on the other, we can make inferences about the strength of this causal connection. These inferences are highly speculative, because they come from separate analyses using somewhat different model specifications. They should be regarded as extremely tentative.

The four panels of table 5 list (a) estimates of the achievement effects of additional academic courses, adapted from Gamoran (1987a, tables 2, 4, and 5); (b) labor market effects of achievement, as reported by Kang and Bishop (1986, table 6) from the same data set; (c) contributions of academic courses—at any level, and at advanced levels—to labor market outcomes via achievement, computed by multiplying the effects in panel (a) by those in panel (b); and (d) for comparison, direct effects of courses on labor market outcomes, net of achievement, from Kang and Bishop (1986, table 5). The computations in panel (c) show, first, no indirect effects on wages, a result of the fact that cognitive skills have no impact on the wages of 19-year-olds, as explained earlier. Second, effects of academic courses without regard to level are also close to zero for months worked and annual earnings. Third, for advanced academic courses, effects on months worked are consistently positive, though still very small. For example, an advanced academic math course would raise months employed by .033, or about one day (30 x .033 = .99), and an honors English course would increase months employed by almost that much. A student who enrolled in two additional years of advanced math and science and honors English, as well as two more years of regular social studies, could expect to work an additional .182 months, or about five and a half days [2 x (.033 + .009 + .002 + .011 + .007 + .029 = .182; and .182 x 30 = 5.46], in the first 21 months after leaving high school. This estimate is highly speculative, and probably reflects a non-linear relation, in which students with more academic training who do not go to college are slightly more likely to work than not to work.

Both Meyer (1992) and Murnane, Willett, and Levy (1993) corrected HSB tests for measurement error using an errors-in-variables approach. With that correction, Meyer found that lower-level math courses such as pre-algebra and algebra 1 (but not basic or general math) contribute more than two points, or about .30 standard deviation, to the HSB math test. Combining this finding with estimates of test score effects on wages from Murnane, Willett, and Levy (1993), one observes that these courses would add close to nothing to wages immediately after high school (because of the weak impact of test scores at that stage), but as much as $0.21 per hour for males and $0.24 per hour for females six years after high school (that is, .30 standard deviation of the HSB age-24 effects, evaluated at the means for males and females). Again, these conclusions are highly speculative, but they are reasonable given available theory and evidence.

Table 5.—Indirect effects of academic courses on labor market outcomes, via cognitive achievement

(a) Achievement effects of academic course (adapted from Gamoran, 1987a)

	TEST SUBJECT		
ACADEMIC COURSE	MATH	READING	VOCABULARY
Any Math Course	.807[a]		
Any Science Course	.186		
Any English Course		-.052	.082
Any Social Studies Course		.049	.092[a]
Advanced Math Course	1.635[a]		
Advanced Science Course	.428[a]		
Honors English Course		.329[a]	.406[a]

(b) Labor market effects of test scores (Kang and Bishop, 1986)

	LABOR MARKET OUTCOME		
	HOURLY WAGES ($)	MONTHS WORKED	ANNUAL EARNINGS ($)
TEST SUBJECT			
Math	-.003	.020	-4.8
Reading	.001	.034	1.1
Vocabulary	.002	.072[a]	28.2

(c) Estimated indirect effects of courses on labor market outcomes (panel a x panel b)

	LABOR MARKET OUTCOME		
	HOURLY WAGES ($)	MONTHS WORKED	ANNUAL EARNINGS ($)
ACADEMIC COURSE			
	Effect via Math Score		
Any Math Course	-.002	.016	-3.874
Any Science Course	-.001	.004	.893
Advanced Math Course	-.005	.033	-2.054
Advanced Science Course	-.001	.009	-7.848

Table 5.—Indirect effects of academic courses on labor market outcomes, via cognitive achievement—Continued

	LABOR MARKET OUTCOME		
	HOURLY WAGES ($)	MONTHS WORKED	ANNUAL EARNINGS ($)
ACADEMIC COURSE			
Effect via Reading Score			
Any English Course	-.000	-.002	-.057
Any Social Studies Course	.000	.002	.054
Honors English Course	.000	.011	.362
Effect via Vocabulary Score			
Any English Course	.000	.006	2.312
Any Social Studies Course	.000	.007[b]	2.594
Honors English Course	.001	.029[b]	11.449

(d) Direct effects of courses on labor market outcomes, net of test scores (Kang and Bishop, 1986)

	LABOR MARKET OUTCOME		
	HOURLY WAGES ($)	MONTHS WORKED	ANNUAL EARNINGS ($)
ACADEMIC COURSE			
Any Math Course	.005	-.270	-4.7
Any English Course	.079	-.175	157.9
Any Foreign Language Course	-.053	.170	-225.3
Any Social Studies Course	-.121[a]	-.146	-190.8
Any Science Course	-.025	.026	-325.9

NOTES:

[a] Coefficient was more than twice its standard error.

[b] Both coefficients on which this figure is based were greater than twice their standard errors.

Interpreting the Evidence

Research on academic course work and labor market outcomes offers evidence of positive effects, but the effects are small and not entirely consistent across studies. There is some tendency for studies that addressed more of the theoretical and statistical complications that confront the research question to observe more often positive effects. Studies that utilized test score controls obtained after course work occurred almost universally found zero or negative effects of course work, whereas studies with controls prior to course exposure (and otherwise reasonably specified) exhibited significant positive effects in two of three studies of wages (for females only: Grasso and Shea, 1979; Daymont and Rumberger, 1982), as well as in the single well-specified study of employment (for both males and females: Daymont and Rumberger, 1982), and in two of three studies of occupational attainment (for males: Griffin and Alexander, 1978; for males and females combined: Hotchkiss and Dorsten, 1987). One other analysis with no controls for test scores, but a statistical model that addressed selection bias, obtained positive effects on wages for foreign language enrollment, and positive effects of math, science, and foreign language combined, but the overall impact was very small (for males and females combined: Altonji, 1992).

A plausible interpretation of this pattern of results is that academic experiences help prepare students to find work, in occupations that are of higher status (relative to jobs held by non-college youth), but have minimal effects on wages, especially for men, in the early years after high school. This conclusion, while very tentatively drawn from studies of course work and job success, is substantiated by research on academic skills and labor market outcomes. Although academic skills have virtually no impact immediately after high school (Bishop, 1985, 1993), in the long run, academic skills are associated with higher earnings, even among persons with the same amount of schooling (Crouse, 1979; Blackburn and Neumark, 1993; Cameron and Heckman, 1993). In the short run, those with higher test scores are more likely to find jobs (Kang, 1984; Kang and Bishop, 1986; Rivera-Batiz, 1992; Rosenbaum and Binder, 1994). Effects on wages in the early career appear larger for women than men, and the impact of skills on wages six years after high school may be increasing (Murnane, Willett, and Levy, 1993). To the extent that academic course work bolsters academic skills, as indicated by numerous studies, it is reasonable to conclude that research on skills and job success supports the conclusion that course work contributes to labor market outcomes.

Combining both sources of evidence yields partial support for predictions stated earlier: (1) Effects of academic skills and courses on wages are weak at labor market entry (non-linear effects of courses were not examined with controls for prior ability); (2) Effects on wages increase with age, but effects on employment do not; (3) No studies considered variation in effects across occupational fields, but effects on wages differ for men and women, which may reflect occupational differences; (4) One study of math skills suggests that positive effects on wages may have grown between the 1970s and the 1980s (Murnane, Willett, and Levy, 1992), and another study suggested that academic program effects on wages may have increased during the 1960s and early 1970s (Grasso and Shea, 1979).

The most troubling contradiction to this assessment and interpretation of the evidence is that no study found significant positive effects of academic course work on annual earnings. This includes not only studies that considered earnings in the early career (Grasso and Shea, 1979; Gustman and Steinmeier, 1982; Gardner, 1984), but also one study with a follow-up 13 years after high school (Griffin and Alexander, 1978). Results obtained by Gustman and Steinmeier (1982) and Gardner

(1984) might be explained away by sample and measurement problems, but no such objections were raised for Grasso and Shea (1979), who reported non-significant positive coefficients for men and women, or Alexander and Griffen (1978), who observed a significant negative effect for men. Since other work indicated positive effects on employment in the short term and on wages in the long term, the finding of zero or negative effects on earnings was surprising. Moreover, researchers have reported positive effects of academic skills on earnings, so one would expect the pattern to hold for academic course work. The lack of comparable effects for course work is unresolved, and remains an important qualification to the tentative conclusions of positive effects on wages, employment, and occupational status.

Another concern is that results from studies that bear directly on the question—that is, models of academic curriculum effects on labor market outcomes—have been less consistent than results from studies of curriculum and achievement, and achievement and labor market outcomes. Why is this the case? On the one hand, it is not surprising that studies of more proximate causes and effects exhibit stronger relationships. Each step in the causal chain is weakened by outside complications, not all of which are addressed in the statistical models. Some slippage may be expected.

On the other hand, model specification problems may have led to overestimates in one literature or underestimates in the other. Effects of course taking on achievement may overstate the benefits of academic courses for students who do not pursue further schooling. This is because most results in this literature pertain to the average student, but students who do not pursue postsecondary schooling are probably below average in how much they learn in academic courses (Alexander and Pallas, 1984; Gamoran, 1987a). In that case, generalizing from studies of course work on achievement may yield overestimates of the impact of course work on labor market outcomes for non-college youth.

Another way of looking at the situation, however, suggests that effects of academic courses on job success may be underestimated in many cases. Among students who enroll in academic courses, those who benefit most are presumably more likely to enroll in postsecondary education. Those who take a full complement of academic work but who do *not* advance to further education may well be those who, for reasons unobserved in the data, benefit least of all from each additional academic course. Analyses of courses and work outcomes may underestimate the impact of academic courses, particularly when the sample is restricted to non-college students, because of an overrepresentation in the analysis of students who failed to benefit from academic courses. Without information on whether students profited from courses—that is, whether course enrollment led to cognitive gains for the different groups of students, including those who tend to take relatively few academic courses—this ambiguity cannot be resolved.

Empirical evidence gives some credence to the suggestion that negative selection biases have depressed the observed impact of academic courses. First, observed effects with no controls for ability (Altonji, 1992) are much smaller than one would expect, given other evidence of positive effects of ability on wages and earnings (Crouse, 1979). Second, estimates obtained with controls for test scores after course work occurred were largely negative (Kang and Bishop, 1986, 1989), a finding that is difficult to explain unless it reflects negative selection. (Note that Kang and Bishop's models included controls for vocational courses, so the negative effects of academic courses do not simply reflect a foregoing of vocational courses. They may, however, reflect a foregoing of extra-curricular activities or non-school activities, such as part-time jobs.) Third, statistical corrections for labor force participation tend to enhance measured effects, or at least not to depress them (Hotchkiss and Dorsten, 1987). This pattern obviously reflects the greater likeli-

hood of students who take many academic courses to enter postsecondary education rather than the labor force, but it may also reflect a negative selection bias for work outcomes among students who take many academic courses but who do not pursue further schooling. (In contrast, adjustment for labor force participation reduces the observed impact of cognitive ability at ages 25 and 28, [Cameron and Heckman, 1993], because more able persons are more likely to work once they leave school.)

Qualitative work adds depth to the tentative conclusion that the consequences of academic work in high school are more salient for finding a job and rising in one's occupation than for initial wages. Interviews with employers suggested that a minimum level of skills is required to compete for jobs, but beyond this threshold, cognitive skills make little difference at entry level. No quantitative analysis specified this type of non-linear model. Once a job is obtained, prospects for advancement depend in part on prior cognitive preparation. As one employer explained to Rosenbaum and Binder (1994, p. 9):

> "There are some [reading and math] deficiencies [among employees], but none that would probably keep them from performing their entry-level jobs. [But] it may affect them, you know, when it comes time to move up the ladder....Once they get on to a piece of equipment, once they're performing a job that requires regular reading of customer job tickets...or written instructions from their supervisor, then it could become more of a problem."

Research on course work and achievement suggests that relevant skills are enhanced by academic courses taken in high school.

Conclusions

Implications of this review are clearer for research than for policy. That is because work conducted so far has raised many questions but answered few with confidence.

Implications for Research

Research to date has been hampered by data and modeling limitations, but it points towards an agenda for future studies. The near-absence of short-term effects on wages, and the presence of short-term effects on employment, are fairly well established when studies of course work and skills are both considered. In the future, we will need more evidence on long-term effects of course work on wages and earnings. New studies must control for cognitive skills prior to high school course work, and use data on subsequent test scores to assess the hypothesis that growth in cognitive skills is the mechanism through which academic courses enhance labor market opportunities. Additional mechanisms, such as career mobility and on-the-job training, should also be considered. A well-specified study would adjust for varied propensities to participate in the labor force at different career stages.

Ideally, new research would allow one to disentangle the effects of (a) years of schooling; (b) certification/diplomas; (c) academic experiences in school, i.e. course work; and (d) cognitive skills gained through academic experiences. Such a study could follow Kang and Bishop's (1989) approach of allowing for non-linear effects of academic courses, and for tradeoffs between academic and vocational courses, but with an additional set of test scores obtained prior to course work. New research could also follow Hotchkiss (1993) in considering the possibility that effects

may differ for varied occupational fields. Studies adopting this type of design would be better suited than existing research to address the predictions derived from theoretical formulations and presented earlier in this review. As noted by Altonji (1992), the 1992 follow-up of High School and Beyond will provide a new, rich source of information for addressing these questions.

Because there are many countries that exhibit tighter linkages between secondary school and the labor market than exist in the U.S. (U.S. General Accounting Office, 1990), comparative research on the transition to work is also called for. Comparative studies could assess the impact of academic course work and skills on work outcomes in systems such as Germany, where apprenticeships provide key connections between school and work, and Britain, where training programs select students partly on the basis of school performance and prepare them for the workplace.

Implications for Policy

Policy recommendations derived from such tentative evidence must be tendered with great caution. Unlike the implications for research, the evidence does not point clearly to new directions for policy. It is, however, consistent with several current policy trends.

The evidence reviewed is consistent with arguments advanced by Bishop (1989), Rosenbaum (1989), and others that both individuals and firms would benefit from improvements to the transition from school to work for persons who terminate their schooling after high school. Academic course work and skills would matter more for the workplace than they do now if there were better articulation between the worlds of school and work. An assessment of competencies, such as that proposed by the Commission on the Skills of the American Workforce (1990), might be part of this system (see also Berryman and Rosenbaum, 1992). Such a system would allow firms to take better advantage of the productivity benefits of more able workers (by identifying more able workers earlier on), and applicants would realize more of the benefits of their own skills (because they could show evidence of skills to employers). As Bishop (1989) and Rosenbaum (1989) argued, increasing the salience of high school performance for job selection and advancement may induce students to take more academic courses, and to take them more seriously.

Evidence obtained so far is also consistent with the move towards eliminating the general track, as is occurring in several states (Olson, 1993). To the best of our current knowledge, both academic courses and job-related vocational courses add more to labor market outcomes than general and remedial courses. The contrast between academic- and general-track work outcomes is supported by the achievement benefits of the academic track, which presumably mediate the impact of academic courses on labor market outcomes.

Plans to improve the integration of academic and vocational studies (e.g., Stern et. al, 1988, 1989; Grubb and Stasz, 1992) are also consistent with the research reviewed in this report. Both by enriching academic course sequences for non-college-bound youth, and by better incorporating academic study into vocational courses, labor market outcomes may be improved, if current findings generalize under such systemic change. If the general track were eliminated and students who did not continue to college had better academic preparation, they would at least have better opportunities to find work, according to the evidence uncovered so far.

Yet it would be naive to conclude that one can simply thrust low-achieving students into the midst of the current academic regime. Indeed, two studies indicated that initially low-achieving students may not benefit much from advanced academic courses (Alexander and Pallas, 1984; Gamoran, 1987a). Rather, the findings call for innovative ways of stimulating and motivating

young persons. Part of this may be the new incentive structure that is supposed to arise when course work and/or tests are more clearly relevant for job applications. Another element may be to place academic learning in an applied context so as to make academic skills more useful and meaningful to students. As Sticht (1990, p. 125) claimed, "[Academic] skills are best learned within a context that is meaningful to students, instead of in the decontextualized manner characteristic of academic education."

Finally, it is worth noting that arguments for enhancing the academic experiences of non-college-bound youth rest on firmer foundations than their labor market impact. From the standpoint of an individual choosing a high school program or course sequence, it is generally wise to take more academic courses, because this leaves open future opportunities to enroll in postsecondary education. Moreover, academic courses are important because they provide access to valued ideas and knowledge. Thus, narrowly focused evidence on courses, skills, and job success, and the broader argument about intellectual development and citizenship, are complementary in their call for increased attention to academic study among young persons not bound for college.

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The Effect of High School Vocational Education on Academic Achievement Gain and High School Persistence: Evidence from NELS:88

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Abstract

In this paper, data from the National Education Longitudinal Study of 1988 (NELS:88) are analyzed to assess the influence of vocational programs and vocational courses on gains in high school achievement in mathematics, science, and reading. The analysis also examines whether, regardless of their effect on achievement gain, vocational programs serve to keep students from dropping out of high school.

The first set of analyses examined the achievement levels of students in academic, vocational, and general high school programs. The results indicate that students in vocational programs do not perform as well in mathematics, science, and reading as students in academic programs. Achievement differences between students in vocational and general programs were mostly insignificant. The second set of analyses examined the effect of individual vocational courses on 10th to 12th grade achievement gain in mathematics, science, and reading. Overall, no significant effect of vocational coursetaking, positive or negative, on achievement gain in mathematics, science, or reading was found.

The high school retention analysis examined the effect of vocational education on whether a student dropped out of high school after the 10th grade. Initial results showing that vocational program participation was associated with lower dropout propensity than general program participation were suspect because of a confound between program participation and dropout status. Dropouts were often not in school long enough to meet program participation requirements and so were classified as being in a general program. Analyses using the number of vocational courses taken in grades 9 and 10 to predict dropout status in grades 11 and 12 showed mixed results. When class rank and number of classes cut were not included in the analysis, vocational coursetaking appeared to significantly reduce dropout status. When class rank and class cutting were included, vocational coursetaking had no effect on dropout status. This suggests that vocational coursetaking in the first two years of high school may have an indirect effect on dropout status, mediated by performance. Followup analyses indicate that vocational courses in agriculture and in the technical/ communications area may have a direct effect in reducing the dropout rate.

One of the main functions of high school vocational education is to give work force preparation to students who were not planning to go to college directly after high school. However, vocational education also has the potential to help students increase their skills in academic areas. For example, vocational courses that cover technical topics may influence mathematics and science achievement. In addition, vocational programs may serve to keep students who are not attracted to college preparatory curricula from dropping out of high school.

Results from prior research on both of these topics have been mixed. Meyer (1992) reports results by Pallas and Alexander (1983) who show negative effects of applied mathematics courses on gain in mathematics achievement. However, his own analysis shows small positive effects of math-related vocational education on mathematics achievement when statistical biases neglected by previous researchers are taken into account. Kulik (this volume) reviews the literature on the effects of vocational education programs on high school dropout rates. He points to mixed results, but concludes that the methodologically stronger studies show a positive direct effect.

Methodology

The research in this report uses data from the National Education Longitudinal Study of 1988 (NELS:88) High School Transcript Study to assess the influence of vocational programs and vocational courses on gains in high school achievement in mathematics, science, and reading. The analysis also addresses the effect of vocational education on lowering the dropout rate.

NELS:88, sponsored by the U.S. Department of Education's National Center for Education Statistics (NCES), is a longitudinal study of a national cohort of 1988 8th graders. A national probability sample of more than 1,000 8th grade-schools and more than 24,000 eighth grade students were selected in 1988; the students, their parents, and their teachers and school administrators were then interviewed. The students were administered achievement tests in mathematics, science, reading and social studies. Students were interviewed and tested again in 1990 and 1992, when most of them were high school sophomores and then seniors. Transcript data spanning the three or four years of high school were collected for students in the NELS:88 second follow-up survey.

Transcripts were collected for 14,625 of the 18,116 students in the NELS:88 10th- to 12th-grade panel sample. Transcript data were available for regular students, dropouts and students in alternative high school programs, and for all early graduates. The transcript data collected from schools included student-level data and complete coursetaking histories. All analyses are conducted using the NELS:88 10th- to 12th-grade panel sample along with a case weight which provides an adjustment for respondents for which transcript data were not available. In addition, all estimates and standard errors were conducted taking into account the clustering and stratification used in the NELS:88 sample design.

Results

The first analysis examined the level of vocational coursetaking. Table 1 shows sample sizes for subgroups used as control variables in this analysis and presents the average number of vocational course Carnegie Units and the percentage of total Carnegie Units taken as vocational courses.[1] On average, this population spent over three-and-one-half Carnegie Units (or about seven one-semester courses) in vocational courses. Because public schools are more likely to have vocational programs, as expected, students in public high schools took more vocational courses than students in private high schools. Students in rural areas took more vocational courses than those in urban and suburban areas and those in the lowest three socioeconomic quartiles took more vocational courses than those in the highest socioeconomic quartile. Students of Asian/Pacific Islander ancestry were least likely to take vocational education courses. Students who never dropped out of high school took a greater number of vocational courses than did dropouts, and handicapped students took a greater number of vocational courses than non-handicapped students.

Table 1 also shows vocational coursetaking as a percentage of total Carnegie Units. Because the total number of units is more or less constant at about 24 across subgroups (except for

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[1] A Carnegie Unit is a standardized measure of coursetaking. One Carnegie Unit is earned for every course that meets for five 50–55 minute periods per week for an entire school year. Thus, a one semester-course would earn one-half unit.

dropouts), the subgroup percentage differences follow the pattern of the average Carnegie Units for vocational coursetaking. The student/dropout percentage difference is an exception. As noted, students show more Carnegie Units in vocational education than dropouts. However, dropouts show a higher percentage of total Carnegie Units spent in vocational education. This indicates that vocational education makes up a higher proportion of the dropout's educational experience. Therefore, it is particularly important to examine the relationship between vocational education and achievement for dropouts. It is also important to examine how vocational programs affect the dropout rate. Both of these issues will be taken up in a later section.

In the following sections, results are presented that assess the relationship between vocational coursetaking and achievement. First, achievement levels of students in different curricular programs are examined. Next, the relationship between vocational coursetaking and gain in mathematics, science, and reading achievement from tenth to twelfth grade are observed. In the assessment of gain controls for school, demographic, and background factors on the one hand, and coursetaking in academic and other nonvocational areas on the other, are included. Finally, dropout rates of students in vocational programs, compared to dropout rates of students in academic and general curricular programs, are examined.

Achievement Levels of Students in Different High School Programs

One criticism of vocational education is that it is a repository for low-achieving students. To examine this, average achievement test scores of students in academic, vocational, and general high school programs were compared. Table 2 shows the mean 10th- and 12th-grade mathematics, science, and reading achievement scores[2] across the different curricular program types[1].

Achievement scores of students in vocational programs are substantially lower than those of students in academic programs, and are sometimes less than achievement scores of students in the general category. Statistical tests of differences in achievement between the programs were conducted using regression analysis[4]. Contrast variables examining the difference in achievement between academic and vocational programs, on the one hand, and a general high school program, on the other, were used as independent variables along with the control variables listed in table 1 in a regression of achievement scores. Results indicate that vocational program students score significantly lower than general program students in 10th-grade mathematics achievement ($t=1.965$, $p=.05$) and in 10th- and 12th-grade reading achievement (10th-grade reading, $t=2.75$, $p=.006$; 12th-grade reading, $t=2.46$, $p=.014$).

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[2] Achievement scores used in these and the following analyses in this report are the Item Response Theory-scaled number correct (IRT Number Right) in mathematics, science, and reading.

[1] Curricular program type was defined by categories of the variable F2RSPFLG, which uses the NAEP:87 criterion for defining program type using Carnegie units for courses taken. The Academic category in Table 2 includes course patterns labeled "Rigid Academic", "Academic", "Rigid Academic and Vocational", and "Academic and Vocational". The Vocational category included students who met the criteria for Vocational Program, but not the criteria for Academic or Rigid Academic Program. Rigid Academic and Vocational and Academic and Vocational were included in the Academic category for analyses conducted for this report. The General category included students who did not meet the criteria for either the Academic or Vocational Programs. Further details are provided by Ingels et al. (1994), Appendix H, p. 27.

[4] All statistical tests were calculated using the SUDAAN program. This program uses information about the survey design to produce estimates of standard errors. Survey design information relevant to the NELS:88 data are stratification, clustering, oversampling, and weighting to account for nonrespondents.

Vocational Coursetaking and Achievement Gain

Ideally, vocational education courses should be structured to impart vocational skills and to reinforce or introduce standard academic content as it applies to a vocational area. This section examines the relationship between vocational coursetaking and achievement. Table 3 presents unstandardized regression coefficients between vocational coursetaking across the entire high school experience and 12th-grade achievement in mathematics, science, and reading[5].

For all three indicators of achievement most of the coefficients are negative. This suggests that vocational courses may have a negative impact on achievement in these three traditional academic areas. The exception is technical/communications, for which a positive coefficient is found. This positive coefficient is largest, relative to its sampling variation, for mathematics achievement, suggesting that technical/communications courses significantly influence math achievement.

However, the coefficients presented in tables 3 may be misleading because the simple relationship between vocational coursetaking and achievement may be mediated by other factors, such as students' prior achievement levels. For example, with respect to the negative relationships, it may be the case that students who received low scores on their achievement tests early in high school were more likely to take vocational courses during the rest of their high school tenure. If this is so, then because 12th-grade achievement scores are related to earlier achievement scores, the zero-order relationships between vocational education coursetaking and 12th-grade achievement would be negative. If this were the case, it would be wrong to conclude from this negative zero-order relationship that vocational education courses depress the achievement of the students who take them, rather than recognizing selection bias as the main source of the negative association.

In addition, the simple relationships between vocational coursetaking and achievement do not take into account the influence of academic coursetaking, background characteristics, and other demographic factors on achievement. If taking certain vocational courses is associated with taking other nonvocational courses, and if the nonvocational courses are associated with achievement, any analysis that does not account for the nonvocational courses and their impact on achievement would give a biased indication of the influence of vocational education on achievement. Similarly, if taking vocational courses is associated with background factors, and these in turn are associated with achievement, then not taking the background factors into account would result in misleading conclusions about the relationship between vocational coursetaking and achievement.

Multiple regression is a technique suitable for controlling the effects of prior achievement, nonvocational coursetaking, and background characteristics, while assessing the impact of vocational coursetaking on achievement. Because other variables related to achievement are included in the analysis, multiple regression becomes a means of examining the relationship between coursetaking and achievement gain independent of the other variables. Two-stage least-squares regression (Johnson, 1984) was used to examine the effect of vocational coursetaking on 10th- to 12th-grade achievement gain, independent of academic coursetaking and independent of school and student background characteristics. This technique was used because

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[5] The unstandardized regression coefficient is the predicted increase or decrease in 12th-grade achievement for every unit increase in coursetaking. For example, if the unstandardized regression coefficient between math achievement and coursetaking in calculus were 1.50, the predicted difference between students who took no calculus and students who took one Carnegie Unit of calculus would be one-and-a-half achievement points.

when prior achievement is included in the regression analysis, negative bias in parameters may result due to measurement error in the 10th-grade achievement variable (Meyer, 1992).

The two-stage least-squares regression technique was used to examine the effect of vocational coursetaking on 10th- to 12th-grade achievement gain, independent of academic coursetaking and independent of school and student background characteristics[6]. In the first stage of the analysis, 10th-grade achievement in mathematics, science, and reading were predicted from composite indices of 9th- and 10th-grade vocational and academic coursetaking, on the one hand, and 11th- and 12th-grade vocational and academic coursetaking, on the other. Ninth and 10th-grade coursetaking were used as instrumental variables to create a predicted value of 10th-grade achievement that was uncorrelated with errors of measurement in 12th-grade achievement. Eleventh and 12th-grade vocational and academic coursetaking were included to control for student self-selection into vocational and academic tracks in their junior and senior year based on their earlier high school performance. Finally, student and school background characteristics were also included in the first-stage analysis.

In the second stage of the analysis, 12th-grade achievement was predicted from vocational and academic coursetaking in the 11th and 12th grade. Student and school background characteristics were included in the analysis along with 10th-grade achievement scores predicted from the first stage analysis. The results of the second stage of the analyses for mathematics, science, and reading, for the entire sample and for dropouts are presented in tables 4 through 9.

Gain in mathematics achievement. Results of the two-stage least-squares regression analyses for mathematics achievement are shown in tables 4 and 5. The best predictor of 12th-grade math achievement was 10th-grade math achievement. When the entire sample is considered, vocational courses do not explain significant variation in gain in mathematics achievement. Significant positive effects were found for coursetaking in Algebra I, Algebra II, Geometry, Precalculus, Calculus, and Physics.

Gain in science achievement. Results of the two-stage least-squares regression analysis for science achievement are shown in tables 6 and 7. As with mathematics, the best predictor of 12th-grade science achievement is 10th grade science achievement. For the entire sample, vocational courses did not have significant positive effects on gain in science achievement. Significant positive effects for science were found for Science Survey courses, Chemistry, Physics and Foreign Language. The effect of Biology was marginally significant.

Gain in reading achievement. Results of the two-stage least-squares regression analysis for reading achievement are shown in tables 8 and 9. As with math and science, 12th-grade test scores were best predicted by 10th-grade test scores. There were no significant effects of vocational coursetaking on gain in reading achievement in the overall analysis, although Consumer Education had a marginally significant negative effect while Specific Labor Market Preparation had a marginally significant positive effect.

Subsample analyses. Results from analyses of the dropout subsample also indicated little impact of vocational coursetaking on academic achievement. The only significant effects were a

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[6] Two-stage least squares regression was implemented by conducting two separate regression analyses. The first analysis regressed 10th-grade achievement on 9th- and 10th-grade coursetaking (instrumental variables), 11th- and 12th-grade coursetaking, and background characteristics. The second analysis regressed 12th-grade achievement on 10th-grade predicted achievement (obtained from the model specified in the first analysis), 11th- and 12th-grade coursetaking, and background characteristics.

negative coefficient for health occupation studies and a positive coefficient for specific labor market preparation on reading achievement (see table 9). Other subsamples, including students in public schools, rural schools, vocational programs, special education, and members of various minority groups and socioeconomic levels, showed similarly small effects of vocational coursetaking (results not shown, but available from the authors upon request).

Vocational education and dropout rates. While vocational courses do not appear to have an appreciable effect on math, science, and reading achievement, it is possible that vocational programs may keep students from dropping out of high school. This possibility was examined by assessing the dropout rate (here defined as the ratio of students who had dropped out of school by the 12th grade to students who were not classified as dropouts in the 10th grade) by high school program type. For the data used in this report the overall dropout rate was 5.6 percent. For students in academic programs the dropout rate shrinks to a little more than a quarter of a percent (.26 percent). In sharp contrast, nearly one out of every four (24.58 percent) students in general programs drop out of high school during their junior and senior years. The dropout rate for vocational programs (4.01 percent) is larger than for academic programs, but is considerably smaller than for general programs.

Logistic regression was used to test whether these differences were significant. Because it is important to control for background characteristics when assessing the effect of curricular program on the dropout rate, background characteristics were included in the analysis. Prior achievement was also included. Two measures of prior achievement were available, 10th-grade achievement in math, science, and reading, and class rank. Both variables seem important: achievement because of the careful way it was measured in the NELS:88 survey, and because of its traditional importance in educational research, and class rank because it is a measure of relative performance and may be more salient to the student as a measure of his or her academic performance and motivation. Both are relatively independent measures of achievement; the measures correlate only about .34. Unfortunately, both measures have fairly high missing data rates and, when used together in the analyses, reduce the number of cases by about one-third.

Three logistic regression analyses were conducted to assess the effect of curricular track on the dropout rate. The first analyses used 10th-grade achievement, the second used class rank, transformed to a logit to improve the distribution, and the third used both achievement and class rank. Though the number of missing cases was higher when both achievement and rank were included, the results of the three analyses were essentially the same. Table 10 presents the results of the analysis using both 10th-grade achievement and class rank. The 10th-grade achievement variable used was the sum of the IRT-number right scores on the math, science, and reading tests. In this table a negative coefficient indicates that a variable decreases the dropout rate while a positive coefficient indicate that it increases the dropout rate.

Table 10 results indicate that the proportion of students who drop out in the 11th and 12th grades is significantly less in vocational programs compared to general programs. Results are supportive of similar analyses conducted on national studies in the past (Grasso & Shea, 1979, Perlmutter, 1982, Wagner, 1991) and summarized by Kulik (this volume). Dropout rates were lower in course pattern-determined vocational programs than in general high school programs. The coefficients for vocational program from each of the three models suggest that students in vocational programs are 8 to 10 times less likely to drop out of high school in their third and fourth years if they are in a vocational program, compared to a general high school program. Academic track students are much less likely to drop out than either general or vocational students.

Using the transcript-defined program classification in assessing the effect of vocational education on dropouts presents a difficulty; students who drop out may not be in school long enough to qualify for membership in either the academic or vocational programs. By default they drop into the general high school program category, with the result that dropout rates in this category are artificially inflated while dropout rates in the vocational and academic categories are artificially depressed[7]. In fact, this would appear to be true in any research where program classification is used to determine a vocational concentrator, unless one assumes that students are tracked into vocational, academic and general programs very early during their high school tenure.

An alternative analysis was designed to attempt to overcome the confounding of curricular program categorization and dropping out. The alternative analysis examined the effect of vocational coursetaking in 9th and 10th grade on the dropout rate in 11th and 12th grade. From this analysis one can see the effects of taking vocational courses in the first two years on dropout rates in the latter years. Results are presented in tables 11, 12 and 13.

Table 11 shows the results of a logistic regression analysis in which 11th- and 12th-grade dropout status is predicted from vocational and academic course Carnegie Units in 9th and 10th grade, background factors, special program participation (special education, bilingual, or gifted vs. no special program, as indicated on the students' transcripts), class rank (from transcripts) and the number of times the student reported skipping classes (from the NELS:88 Second Follow-up Student Questionnaire). When all of these variables are included in the regression analysis, the effect of vocational coursetaking on the dropout rate is not statistically significant.

Kulik (this volume), who has reviewed the literature on the issue of high school program participation and dropping out, has argued that it is inappropriate to include factors such as class rank and absence from class in assessing the impact of vocational eduction on the dropout rate. His reasoning (Kulik, 1994) is that these factors are themselves outcomes and should not be confounded with other outcomes such as the dropout rate in the same analysis.

He cites as defense of this argument the study by Wagner (1991) who analyzed data from the National Longitudinal Transition Study of Special Education Students (NLTS), and found a 2.7 percent advantage in dropout rate for vocational students compared to nonvocational students. Her analysis included absenteeism and course failure as predictor variables. However, when she left absenteeism and course failure out of the model, the decrease in the dropout rate due to vocational education rose to 8 percent.

In response to Kulik's argument, the dropout rate in the NELS:88 data was modeled using vocational and academic coursetaking and background characteristics, but leaving out other school-related variables. Table 12 shows the results when class rank, number of classes skipped or cut, and special program participation are removed from the model. The coefficient for vocational courses is negative, indicating that it is associated with a lower dropout rate, and is statistically significant. Each additional Carnegie Unit in vocational education courses in the first two years of high school reduces the dropout rate 1.14 times. For example, for the overall dropout rate of 5.6 percent, an additional Carnegie Unit of vocational education would reduce the rate to 4.9 percent. For the general program dropout rate of 24.58 percent, an additional Carnegie Unit in vocational education would reduce the dropout rate to 21.56 percent. In each

[7] I am grateful to Professor Robert Meyer of the University of Chicago for pointing out this problem in his review of this manuscript.

case, the estimated reduction in the dropout rate is about 12 percent. The magnitude of the coefficient for vocational courses changes very little and remains significant when the special program indicators are added to the model (table 13).

Comparing across tables 11, 12, and 13 it appears that the variable most responsible for reducing the effect of vocational education is class rank. The question remains whether it is appropriate to include class rank in the model because of its status as an outcome variable that is affected by vocational coursetaking. It is appropriate to include class rank because rank is related to vocational coursetaking and to dropout status. Eliminating class rank from the model predicting dropout status would result in model misspecification. Bias due to model misspecification would be in attributing a direct effect of vocational education on the dropout rate. Rather, the results suggest that vocational education may have an indirect effect on the dropout rate, and that the effect may be mediated through class rank. This interpretation suggests further that vocational education may deter students from dropping out because it allows them to perform better in relation to other students, and it is this improved performance, perhaps because it represents a success experience, that keeps them in school. However, the results are not conclusive because of the inability to account completely for student motivations regarding coursetaking and the decision to drop out of high school.

The final analysis investigated whether coursetaking in individual vocational areas had direct effects on the dropout rates. Results are shown in table 14. Courses in agriculture and technical/communications taken in the 9th and 10th grades significantly reduce the likelihood of dropping out in the 11th and 12th grades. In contrast, courses in consumer economics significantly increase the likelihood of dropping out. Because class rank is included in the model, these effects cannot be attributed to their effect on class rank.

Summary and Conclusions

Data from the National Education Longitudinal Survey of 1988 8th Graders (NELS:88) transcript study and student cognitive testing administration were used to assess the effect of vocational programs and vocational courses on achievement in mathematics, science, and reading, and on student dropout rates. Analyses were conducted which took into account differences in student characteristics, school type, and student achievement.

Results of the effects of curricular program on achievement indicate that students in vocational programs do not score as high in mathematics, science, and reading as students in academic programs, supporting findings by Alexander, Cook, & McDill (1978) and Alexander & Cook (1982, but see Jencks and Brown, 1975 and Meyer; 1992, who show no difference and a positive influence of certain vocational courses, respectively). Vocational program students' scores in mathematics and science do not differ significantly from students in general high school programs. Vocational program students' reading scores are significantly lower than those of students in general programs. These results hold even when a number of student background and educational characteristics are included as control variables in the analysis.

Results of the effects of vocational coursetaking on achievement in mathematics, science, and reading indicate no impact of vocational courses on gain in performance in these areas. With a few scattered and inconsistent exceptions, vocational courses taken in the 9th and 10th grade had no effect on achievement gain from 10th to 12th grade.

The analysis of dropout rates indicates that vocational education may play a role in keeping students in school. However, that role may be indirect, operating through the mechanism of improving students'

grades and standing with respect to others in their school. Though it was not explicitly tested in the present analysis, it is possible that vocational courses serve to raise poorly-performing academic students' sense of accomplishment and improve their image of their capability. These factors may be enough to keep some students from dropping out of high school. Direct effects on reduction of the dropout rate were found for vocational courses in agriculture and technical/communications. Based on the present analysis, it is not unreasonable to assume that there were aspects of the curriculum or course content in these areas that stimulated students' interests in high school.

The analyses presented here suggest that vocational courses, as they are grouped and studied here, have small and inconsistent effects on gain in mathematics, science, and reading achievement. When using these results to gauge the worth of vocational education, it is important to remember that the results do not speak to other utilities of vocational courses. For example, the results of this study do not examine whether the vocational courses effectively prepare students for the work force. If vocational courses do prepare students adequately for the labor market, that may make up somewhat for the lack of an effect on academic achievement.

The results suggest that vocational programs may have some effect, either indirect or direct, on reducing the dropout rate. This is an intriguing finding, and bears further exploration, especially since the current literature presents confusing and contradictory results. In the process of conducting the research for this report, a number of methodological issues have surfaced which have been useful in thinking about both previous research and the results of the analyses presented here. They are mentioned here in the hope that they will be useful in structuring future research on the relationship between vocational education and the dropout rate.

The first issue is whether vocational program participation or vocational courses are used to predict dropout rates. If vocational program participation is used, one must be very careful that students can be accurately placed in vocational programs very early in their high school experience in order to avoid the confound between length of high school tenure and program participation. If it is impossible to make accurate program participation categorizations until later in high school, then it is better to use the number of vocational courses taken in a previous time period to predict dropout status in a subsequent time period.

The second issue concerns which control variables are used in dropout prediction models. To yield an unbiased assessment of the effect of vocational education on dropout rates, models should contain other factors knows to affect the dropout rate. For example, because dropout rates are low among students in academic programs, it is important to include academic coursetaking in any model assessing the effect of vocational courses on dropping out. Similarly, because poor performance and skipping school are related to dropping out, these factors should be included. Other factors representing differences in school or social experiences that are associated with dropping out should be included in the model predicting dropout rates from vocational coursetaking. Part of the confusion in the current literature may be due to a lack of consistency in measuring and including control variables in the analyses.

The third issue concerns whether vocational education has a direct or indirect effect on the dropout rate (Pittman, 1991). This issue is related to the second issue because it concerns whether other, intermediate, outcomes are included. As the analysis in this paper showed, excluding class rank resulted in a positive effect of vocational education on the dropout rate. Including rank eliminated that effect. This suggests both that the model excluding rank may have resulted in a biased parameter estimate for the vocational education effect, and that the effect of vocational education on the dropout rate is mediated through its effect on class rank. This finding

raises the issue of how vocational education may have a non-curricular influence on the high school student's school experience to keep the student engaged in school. This issue could be explored by examining the effect of vocational education on other aspects of the student's school experience available in the NELS:88 data, for example, sense of self-esteem, interest in school, attendance, behavioral problems, aspirations, and other school-related motivational factors. In turn, the effect of these non-curricular factors on the dropout rate could be modeled. The result would be a sophisticated picture of the total vocational education experience, and how this experience can account for keeping students in school.

It should be noted that this approach could be used advantageously to understand direct curricular effects of vocational education as well. The analysis presented in this paper suggests curricular effects on the dropout rate for courses in the agriculture and technical/communications areas, however, the level of the present analysis does not specify what those curricular effects are (see Meyer, 1992 for an example of studying curricular effects of vocational education on achievement). If there is a way to use the NELS:88 data to ascertain the nature of the curriculum in these vocational areas, it would be well worth the time it takes to do so.

In addition, it should be noted that 8th-grade achievement scores were available and could have been used in the analysis. The decision not to include them was based on two considerations: (1) no instrumental variables were available, and (2) a weight allowing the use of the 8th- to 12th-grade panel sample along with transcripts was not available. NELS:88 also contains information on a number of other potential predictors of success in high school, such as student aspirations, attitudes and motivations, and parental support. Researchers who wish to explore this topic further might consider these and other variables available from this rich data source.

The analyses reported here failed to find an effect of vocational performance on achievement. However, they do suggest that vocational education has an effect on the dropout rate, although the results do not clearly show the mechanisms underlying that effect. Even if taking vocational courses do keep students in school, a hidden cost of vocational education is that it limits students' opportunities to take traditional academic courses and may limit students' access to traditional academic knowledge. This is the case because the total number of courses students can take in high school is more or less fixed. For the most part, taking a vocational education course means trading off some other, perhaps traditional academic, course. It appears that this tradeoff, and its effect on academic learning, is being recognized to some extent by students themselves or by school administrators.

Coursetaking patterns including a concentration both in vocational and academic courses were found. Three different vocational program types were identified: (1) a standard vocational track, (2) a vocational and academic track, and (3) a vocational and rigid academic track. The standard vocational track pattern was found among a large number of students with vocational concentrations (43.41 percent). Of all the students with vocational concentrations, these students are least likely to take traditional mathematics and science courses. Fortunately, this is less true for students with the vocational and academic pattern, and fortunately this pattern also makes up an even larger portion of students with vocational concentrations (50.14 percent). It is encouraging to see the emergence of a third combined vocational/academic pattern, students whose curriculum accommodates vocational courses and the more challenging of the traditional academic courses, although this pattern is seen for a very small portion of students with vocational course concentration (6.45 percent).

Table 1.—Average number of vocational course Carnegie units and percentage of total Carnegie units spent in vocational education courses, overall and by various background characteristics

Background Characteristics		Number of vocational Carnegie Units		Percentage of total Carnegie Units	
	Sample Size	Mean	SE	Percent	SE
Overall	14625	3.57	0.051	15.64	0.214
Male	7321	3.66	0.078	16.15	0.330
Female	7304	3.48	0.059	15.12	0.247
Asian/Pacific Islander	1003	2.98	0.176	12.56	0.724
Hispanic	1736	3.48	0.108	16.03	0.486
Black	1325	3.67	0.145	16.58	0.547
White	10392	3.59	0.063	15.55	0.265
American Indian /Alaskan Native	148	3.27	0.312	16.13	1.223
Socioeconomic Status					
Lowest quartile	2873	4.68	0.104	20.96	0.327
Second quartile	3471	4.23	0.091	18.67	0.389
Third quartile	3651	3.50	0.075	15.28	0.324
Highest quartile	4492	2.32	0.074	9.63	0.309
School type					
Public	12659	3.77	0.049	16.60	0.201
Catholic	774	1.73	0.086	6.71	0.334
Independent private	928	0.29	0.105	1.22	0.442
Other private	262	2.03	0.326	7.89	1.142
Urban	4101	2.92	0.084	12.93	0.372
Suburban	5821	3.30	0.070	14.72	0.330
Rural	4701	4.52	0.086	19.33	0.295
Region					
Northeast	2669	3.40	0.171	13.59	0.598
Midwest	4014	3.92	0.093	17.61	0.420
South	4932	3.59	0.073	16.00	0.331
West	3009	3.25	0.082	14.45	0.400
Student	13864	3.59	0.053	15.44	0.219
Dropout	675	2.72	0.119	19.80	0.770
Special education	393	5.06	0.209	23.04	0.865
Bilingual	230	3.26	0.218	14.92	1.081
Gifted	1363	2.18	0.106	8.83	0.441
Mainstream	12411	3.67	0.057	16.12	0.238

SOURCE: NELS:88 Second follow-up transcript study.

Table 2.—Tenth- and 12th-grade achievement by curricular program

	Sample Size	Weighted N	Mean	SE
MATH IRT-ESTIMATED NUMBER RIGHT-10th grade				
Total	11621	1927123	44.358	0.279
Academic Program	9309	1514586	46.669	0.319
Vocational Program	586	99449	34.911	0.720
General Program	1726	313088	36.179	0.531
MATH IRT-ESTIMATED NUMBER RIGHT-12th grade				
Total	12023	2030067	48.404	0.276
Academic Program	9580	1581553	51.151	0.311
Vocational Program	609	107124	38.099	0.804
General Program	1834	341390	38.912	0.536
SCIENCE IRT-ESTIMATED NUMBER RIGHT-10th grade				
Total	11502	1907151	22.037	0.124
Academic Program	9228	1501925	22.854	0.140
Vocational Program	578	97618	18.758	0.326
General Program	1696	307608	19.088	0.266
SCIENCE IRT-ESTIMATED NUMBER RIGHT-12th grade				
Total	11946	2017852	23.416	0.119
Academic Program	9531	1573578	24.331	0.132
Vocational Program	602	106261	20.110	0.288
General Program	1813	338013	20.193	0.245
READING IRT-ESTIMATED NUMBER RIGHT-10th grade				
Total	11621	1930806	31.120	0.216
Academic Program	9303	1517627	32.561	0.244
Vocational Program	585	98873	24.415	0.605
General Program	1733	314306	26.271	0.422
READING IRT-ESTIMATED NUMBER RIGHT-12th grade				
Total	12017	2032916	33.284	0.202
Academic Program	9568	1583130	34.808	0.226
Vocational Program	611	107406	26.859	0.517
General Program	1838	342380	28.249	0.380

SOURCE: NELS:88 Second follow-up transcript study.

Table 3.—Unstandardized regression coefficients indicating the simple relationship between vocational coursetaking and 12th-grade mathematics, science and reading achievement, entire sample, students, and dropouts

	Mathematics Achievement					
	Entire Sample		Students		Dropouts	
Vocational Course	B	SE	B	SE	B	SE
Agriculture	-2.14	0.232	-2.19	0.234	1.17	1.672
Business	-0.89	0.185	-1.02	0.188	0.02	0.897
Consumer Education	-4.04	0.214	-4.05	0.216	-1.04	1.071
General Labor Market Prep.	-3.25	0.270	-3.29	0.273	-0.55	1.001
Health Occupation	-1.23	0.427	-1.29	0.431	-4.96	5.439
Specific Labor Market Prep.	-2.52	0.417	-2.56	0.421	-2.88	1.208
Marketing/Distribution	-1.77	0.390	-1.85	0.389	-2.70	2.698
Occupational Home Economics	-2.54	0.465	-2.51	0.461	-2.54	0.947
Technical/Communications	2.69	0.356	2.54	0.357	5.91	2.502
Trade/Industrial	-1.30	0.158	-1.34	0.162	0.37	0.773

	Science Achievement					
	Entire Sample		Students		Dropouts	
Vocational Course	B	SE	B	SE	B	SE
Agriculture	-0.53	0.103	-0.52	0.103	-0.68	0.489
Business	-0.58	0.073	-0.63	0.074	0.54	0.447
Consumer Education	-1.71	0.100	-1.71	0.101	-0.44	0.461
General Labor Market Prep.	-1.13	0.123	-1.13	0.125	-0.44	0.606
Health Occupation	-0.65	0.221	-0.67	0.223	-2.99	1.047
Specific Labor Market Prep.	-0.71	0.21	-0.71	0.219	-1.35	1.036
Marketing/Distribution	-0.61	0.194	-0.62	0.193	-2.91	1.588
Occupational Home Economics	-1.04	0.136	-1.02	0.134	-0.99	0.383
Technical/Communications	0.87	0.162	0.81	0.163	3.09	1.126
Trade/Industrial	-0.23	0.050	-0.25	0.051	0.38	0.388

	Reading Achievement					
	Entire Sample		Students		Dropouts	
Vocational Course	B	SE	B	SE	B	SE
Agriculture	-1.63	0.18	-1.63	0.18	-0.47	1.34
Business	-0.36	0.12	-0.41	0.12	0.24	0.95
Consumer Education	-2.22	0.20	-2.23	0.21	0.29	0.96
General Labor Market Prep.	-2.03	0.21	-2.02	0.21	-2.48	0.86
Health Occupation	-0.79	0.21	-0.80	0.21	-7.32	3.92
Specific Labor Market Prep.	-1.19	0.33	-1.21	0.34	-0.50	2.07
Marketing/Distribution	-.65	0.28	-0.70	0.28	-1.93	2.94
Occupational Home Economics	-1.47	0.20	-1.44	0.19	-1.35	0.85
Technical/Communications	0.81	0.26	0.75	0.26	1.64	2.98
Trade/Industrial	-1.06	0.15	-1.09	0.16	-0.52	0.53

SOURCE: NELS:88 Second follow-up transcript study.

Table 4.—Second stage of two-stage least squares regression analysis of 12th-grade math achievement on 10th-grade math achievement, vocational course carnegie units, academic course carnegie units, and background characteristics, entire sample

	Coeffieient	Standard error	p
Intercept	8.832	2.329	0.000
10TH-GRADE MATH ACHIEVEMENT	0.930	0.037	0.000
AGRICULTURE	-0.061	0.235	0.794
BUSINESS	-0.103	0.146	0.483
CONSUMER/HOMEMAKING EDUCATION	-0.293	0.191	0.125
GENERAL LABOR MARKET PREPARATION	-0.068	0.192	0.723
HEALTH OCCUPATIONS	-0.166	0.320	0.605
SPECIFIC LABOR MARKET PREPARATION	-0.368	0.243	0.131
MARKETING/DISTRIBUTION	0.071	0.268	0.792
OCCUPATIONAL HOME ECONOMICS	-0.007	0.186	0.969
TECHNICAL/COMMUNICATIONS	0.007	0.256	0.979
TRADE/INDUSTRIAL	-0.115	0.172	0.503
ALGEBRA I	1.394	0.556	0.012
ALGEBRA II	1.716	0.355	0.000
APPLIED MATH-B	0.034	0.509	0.947
BASIC MATH	0.507	0.839	0.546
BIOLOGY	-0.340	0.266	0.202
CALCULUS	1.622	0.550	0.003
CHEMISTRY	0.464	0.295	0.116
COMPUTER MATH	0.390	0.335	0.245
ENGLISH	0.138	0.216	0.521
FINE ARTS	0.036	0.124	0.773
FOREIGN LANGUAGE	0.210	0.196	0.284
GEOMETRY	1.665	0.380	0.000
GENERAL MATH	-0.049	0.540	0.928
PRE-ALGEBRA	0.992	0.607	0.103
PRE-CALCULUS	1.600	0.345	0.000
PERSONAL USE/OTHER	-0.045	0.128	0.723
PHYSICS	0.900	0.325	0.006
SURVEY AND OTHER SCIENCE	0.197	0.432	0.649

SOURCE: NELS:88 Second follow-up transcript study.

NOTE: For tables 4 through 9, results of the first stage analysis and coefficients for background factors in the second stage analysis were left out to save space. The authors will make them available on request.

Table 5.—Second stage of two-stage least squares regression analysis of 12th-grade math achievement on 10th-grade math achievement, vocational course carnegie units, academic course carnegie units, and background characteristics, dropouts

	Coeffieient	Standard error	p
Intercept	8.858	4.866	0.071
10TH-GRADE MATH ACHIEVEMENT	0.828	0.085	0.000
AGRICULTURE	2.786	3.252	0.393
BUSINESS	-0.910	1.170	0.438
CONSUMER/HOMEMAKING EDUCATION	-1.025	1.299	0.432
GENERAL LABOR MARKET PREPARATION	1.514	1.078	0.163
HEALTH OCCUPATIONS	7.635	4.198	0.071
SPECIFIC LABOR MARKET PREPARATION	-0.305	1.596	0.848
MARKETING/DISTRIBUTION	4.181	2.523	0.100
OCCUPATIONAL HOME ECONOMICS	0.106	0.845	0.900
TECHNICAL/COMMUNICATIONS	2.513	2.186	0.252
TRADE/INDUSTRIAL	0.412	1.064	0.699
ALGEBRA I	1.365	2.295	0.553
ALGEBRA II	0.262	3.000	0.931
APPLIED MATH-B	0.588	2.400	0.807
BASIC MATH	4.249	3.474	0.224
BIOLOGY	-1.158	1.777	0.516
CALCULUS	2.720	4.643	0.559
CHEMISTRY	-0.999	3.084	0.746
COMPUTER MATH	-2.298	1.562	0.144
ENGLISH	-2.917	1.175	0.014
FINE ARTS	-0.114	1.203	0.925
FOREIGN LANGUAGE	-1.117	1.950	0.568
GEOMETRY	3.857	2.407	0.111
GENERAL MATH	-1.233	2.728	0.652
PRE-ALGEBRA	0.527	2.484	0.832
PRE-CALCULUS	2.319	4.607	0.616
PERSONAL USE/OTHER	0.492	0.845	0.562
PHYSICS	9.234	7.540	0.223
SURVEY AND OTHER SCIENCE	0.217	1.753	0.902

SOURCE: NELS:88 Second follow-up transcript study

Table 6.—Second stage of two-stage least squares regression analysis of 12th-grade science achievement on 10th-grade science achievement, vocational course carnegie units, academic course carnegie units, and background characteristics, entire sample

	Coeffieient	Standard error	p
Intercept	5.583	1.593	0.000
10TH-GRADE SCIENCE ACHIEVEMENT	0.819	0.056	0.000
AGRICULTURE	-0.095	0.130	0.467
BUSINESS	-0.059	0.067	0.379
CONSUMER/HOMEMAKING EDUCATION	-0.173	0.109	0.114
GENERAL LABOR MARKET PREPARATION	0.016	0.101	0.873
HEALTH OCCUPATIONS	0.010	0.162	0.950
SPECIFIC LABOR MARKET PREPARATION	0.038	0.142	0.790
MARKETING/DISTRIBUTION	0.176	0.156	0.260
OCCUPATIONAL HOME ECONOMICS	-0.065	0.076	0.395
TECHNICAL/COMMUNICATIONS	-0.010	0.137	0.942
TRADE/INDUSTRIAL	0.033	0.063	0.596
ALGEBRA I	-0.474	0.388	0.222
ALGEBRA II	0.235	0.189	0.214
APPLIED MATH-B	-0.450	0.244	0.065
BASIC MATH	-0.046	0.355	0.898
BIOLOGY	0.271	0.139	0.051
CALCULUS	0.082	0.298	0.782
CHEMISTRY	0.515	0.150	0.001
COMPUTER MATH	0.085	0.178	0.631
ENGLISH	0.075	0.109	0.490
FINE ARTS	0.033	0.063	0.607
FOREIGN LANGUAGE	0.246	0.116	0.034
GEOMETRY	0.085	0.210	0.687
GENERAL MATH	-0.554	0.247	0.025
PRE-ALGEBRA	-0.248	0.268	0.354
PRE-CALCULUS	0.217	0.174	0.213
PERSONAL USE/OTHER	0.019	0.075	0.804
PHYSICS	0.552	0.181	0.002
SURVEY AND OTHER SCIENCE	0.793	0.179	0.000

SOURCE: NELS:88 Second follow-up transcript study

Table 7.—Second stage of two-stage least squares regression analysis of 12th-grade science achievement on 10th-grade science achievement, vocational course carnegie units, academic course carnegie units, and background characteristics, dropouts

	Coeffieient	Standard error	p
Intercept	10.560	3.425	0.003
10TH-GRADE SCIENCE ACH.	0.597	0.122	0.000
AGRICULTURE	-0.224	1.043	0.830
BUSINESS	0.573	0.557	0.306
CONSUMER/HOMEMAKING EDUCATION	0.374	0.630	0.554
GENERAL LABOR MARKET PREPARATION	-0.035	0.697	0.960
HEALTH OCCUPATIONS	1.132	2.181	0.605
SPECIFIC LABOR MARKET PREPARATION	-0.092	1.072	0.932
MARKETING/DISTRIBUTION	0.754	1.351	0.578
OCCUPATIONAL HOME ECONOMICS	0.053	0.436	0.904
TECHNICAL/COMMUNICATIONS	1.510	1.066	0.159
TRADE/INDUSTRIAL	0.271	0.535	0.614
ALGEBRA I	0.886	1.079	0.413
ALGEBRA II	2.816	1.238	0.025
APPLIED MATH-B	0.618	1.027	0.548
BASIC MATH	1.397	3.187	0.662
BIOLOGY	0.915	0.709	0.199
CALCULUS	-0.545	2.347	0.817
CHEMISTRY	0.927	1.356	0.495
COMPUTER MATH	0.092	1.158	0.937
ENGLISH	-0.839	0.631	0.186
FINE ARTS	0.376	0.686	0.584
FOREIGN LANGUAGE	-1.317	1.367	0.337
GEOMETRY	0.790	1.057	0.456
GENERAL MATH	1.739	1.539	0.261
PRE-ALGEBRA	0.625	1.590	0.695
PRE-CALCULUS	-0.051	1.408	0.971
PERSONAL USE/OTHER	-0.571	0.578	0.326
PHYSICS	9.390	3.117	0.003
SURVEY AND OTHER SCIENCE	1.640	0.838	0.053

SOURCE: NELS:88 Second follow-up transcript study

Table 8.—Second stage of two-stage least squares regression analysis of 12th-grade achievement on 10th-grade reading achievement, vocational course carnegie units, academic course carnegie units, and background characteristics, entire sample

	Coeffieient	Standard error	p
Intercept	4.790	2.306	0.038
10TH-GRADE READING ACH.	0.878	0.056	0.000
AGRICULTURE	-0.250	0.229	0.276
BUSINESS	0.016	0.116	0.890
CONSUMER/HOMEMAKING EDUCATION	-0.393	0.207	0.057
GENERAL LABOR MARKET PREPARATION	-0.278	0.170	0.102
HEALTH OCCUPATIONS	-0.166	0.259	0.521
SPECIFIC LABOR MARKET PREPARATION	0.472	0.247	0.056
MARKETING/DISTRIBUTION	0.172	0.267	0.519
OCCUPATIONAL HOME ECONOMICS	-0.085	0.169	0.616
TECHNICAL/COMMUNICATIONS	0.109	0.224	0.626
TRADE/INDUSTRIAL	-0.069	0.159	0.663
ALGEBRA I	-0.556	0.750	0.459
ALGEBRA II	0.622	0.345	0.072
APPLIED MATH-B	0.193	0.429	0.653
BASIC MATH	0.562	0.730	0.441
BIOLOGY	-0.092	0.242	0.704
CALCULUS	-0.048	0.391	0.903
CHEMISTRY	-0.002	0.261	0.993
COMPUTER MATH	0.104	0.287	0.716
ENGLISH	0.212	0.183	0.247
FINE ARTS	0.182	0.105	0.082
FOREIGN LANGUAGE	0.117	0.213	0.583
GEOMETRY	0.327	0.403	0.417
GENERAL MATH	-1.138	0.447	0.011
PRE-ALGEBRA	0.019	0.609	0.975
PRE-CALCULUS	0.131	0.302	0.664
PERSONAL USE/OTHER	0.013	0.122	0.912
PHYSICS	0.232	0.302	0.441
SURVEY AND OTHER SCIENCE	0.410	0.362	0.257

SOURCE: NELS:88 Second follow-up transcript study

Table 9.—Second stage of two-stage least squares regression analysis of 12th-grade achievement on 10th-grade reading achievement, vocational course carnegie units, academic course carnegie units, and background characteristics, dropouts

	Coeffieient	Standard error	p
Intercept	8.835	6.265	0.161
10TH-GRADE READING ACH.	0.843	0.163	0.000
AGRICULTURE	-1.499	3.179	0.638
BUSINESS	0.905	1.248	0.470
CONSUMER/HOMEMAKING EDUCATION	-2.020	1.213	0.098
GENERAL LABOR MARKET PREPARATION	-0.141	1.260	0.911
HEALTH OCCUPATIONS	-14.757	5.037	0.004
SPECIFIC LABOR MARKET PREPARATION	3.957	1.982	0.048
MARKETING/DISTRIBUTION	-0.961	2.313	0.679
OCCUPATIONAL HOME ECONOMICS	0.696	0.955	0.467
TECHNICAL/COMMUNICATIONS	-2.936	2.274	0.199
TRADE/INDUSTRIAL	-0.902	0.853	0.292
ALGEBRA I	-0.038	2.449	0.988
ALGEBRA II	-2.266	2.854	0.429
APPLIED MATH-B	3.768	2.687	0.163
BASIC MATH	-0.824	3.800	0.829
BIOLOGY	-2.890	1.471	0.051
CALCULUS	24.061	5.247	0.000
CHEMISTRY	1.663	3.160	0.600
COMPUTER MATH	-0.866	1.987	0.664
ENGLISH	0.178	1.211	0.883
FINE ARTS	0.319	1.180	0.787
FOREIGN LANGUAGE	-3.621	1.872	0.055
GEOMETRY	3.470	2.467	0.162
GENERAL MATH	3.093	2.289	0.179
PRE-ALGEBRA	5.626	2.476	0.025
PRE-CALCULUS	0.000	4.933	1.000
PERSONAL USE/OTHER	-0.636	1.037	0.541
PHYSICS	-18.241	6.626	0.007
SURVEY AND OTHER SCIENCE	2.481	1.750	0.159

SOURCE: NELS:88 Second follow-up transcript study

Table 10.—Logistic regression of 12th-grade dropout status on program type and background characteristics, model including class rank and 10th-grade achievement

	Coeffieient	Standard error	p
Intercept	-2.440	1.382	0.077
ACADEMIC PROGRAM	-3.663	0.471	0.000
VOCATIONAL PROGRAM	-2.059	0.552	0.000
ASIAN	-0.056	1.079	0.959
HISPANIC	0.529	0.499	0.289
BLACK	-0.738	0.458	0.107
NATIVE AMERICAN	1.271	0.731	0.082
PRIVATE SCHOOLS	-4.283	0.416	0.000
SPECIAL ED. PROGRAM	-2.267	1.088	0.037
BILINGUAL PROGRAM	0.137	1.308	0.917
GIFTED PROGRAM	0.803	0.865	0.353
SUBURBAN	-0.028	0.433	0.949
RURAL	-0.591	0.438	0.177
MIDWEST	-0.019	0.511	0.971
SOUTH	0.337	0.555	0.544
WEST	-1.220	0.629	0.053
FEMALE	0.016	0.313	0.958
SES LOWEST QUARTILE	1.535	0.689	0.026
SES SECOND QUARTILE	0.694	0.708	0.327
SES THIRD QUARTILE	0.109	0.831	0.896
10TH-GRADE TEST COMPOSITE	-0.017	0.009	0.057
CLASS RANK (LOGIT)	-0.384	0.110	0.000
NUMBER OF TIMES SKIPPED CLASS			
None	-0.293	0.526	0.578
1-2	0.551	0.540	0.307
3-6	0.190	0.578	0.743
7-9	-1.459	1.236	0.238

SOURCE: NELS:88 Second follow-up transcript study

Table 11.—Logistic regression of 12th-grade dropout status on 9th- and 10th-grade total carnegie units in vocational and academic courses, model including special program categorization, class rank, and number of time skipped classes

	Coeffieient	Standard error	p
Intercept	-3.580	1.081	0.001
ALL VOCATIONAL	0.020	0.082	0.810
ALL ACADEMIC	-0.298	0.049	0.000
ASIAN	1.186	1.015	0.243
HISPANIC	0.547	0.472	0.247
BLACK	-0.115	0.341	0.737
NATIVE AMERICAN	0.761	0.633	0.230
PRIVATE SCHOOLS	-1.643	1.020	0.107
SPECIAL ED. PROGRAM	-1.454	0.579	0.012
BILINGUAL PROGRAM	-0.385	0.767	0.615
GIFTED PROGRAM	-0.819	0.769	0.287
SUBURBAN	0.085	0.349	0.808
RURAL	-0.127	0.357	0.722
MIDWEST	0.431	0.356	0.226
SOUTH	0.181	0.331	0.583
WEST	-0.471	0.394	0.232
FEMALE	0.519	0.272	0.056
SES LOWEST QUARTILE	1.507	0.448	0.001
SES SECOND QUARTILE	1.195	0.463	0.010
SES THIRD QUARTILE	0.590	0.483	0.222
CLASS RANK (LOGIT)	-0.432	0.062	0.000
NUMBER OF TIMES SKIPPED CLASS			
None	-0.539	0.339	0.111
1-2	-0.135	0.426	0.751
3-6	0.223	0.441	0.613
7-9	-0.094	0.503	0.853

SOURCE: NELS:88 Second follow-up transcript study

Table 12.—Logistic regression of 12th-grade dropout status on 9th- and 10th-grade total carnegie units in vocational and academic courses, model excluding special program categorization, class rank, and number of times skipped classes

	Coeffieient	Standard error	p
Intercept	-0.693	0.515	0.178
ALL VOCATIONAL	-0.132	0.052	0.011
ALL ACADEMIC	-0.461	0.035	0.000
ASIAN	0.290	0.675	0.667
HISPANIC	0.570	0.221	0.010
BLACK	-0.124	0.213	0.560
NATIVE AMERICAN	1.505	0.724	0.038
PRIVATE SCHOOLS	-1.165	0.677	0.085
SUBURBAN	0.054	0.185	0.771
RURAL	0.123	0.202	0.543
MIDWEST	-0.098	0.261	0.709
SOUTH	0.170	0.240	0.479
WEST	-0.464	0.277	0.094
FEMALE	0.378	0.148	0.011
SES LOWEST QUARTILE	1.488	0.256	0.000
SES SECOND QUARTILE	0.987	0.250	0.000
SES THIRD QUARTILE	0.730	0.261	0.005

SOURCE: NELS:88 Second follow-up transcript study

Table 13.—Logistic regression of 12th-grade dropout status on 9th- and 10th-grade total carnegie units in vocational and academic courses, model including special program categorization

	Coeffieient	Standard error	p
Intercept	-0.572	0.520	0.272
ALL VOCATIONAL	-0.143	0.052	0.006
ALL ACADEMIC	-0.455	0.035	0.000
ASIAN	0.363	0.693	0.601
HISPANIC	0.670	0.218	0.002
BLACK	-0.139	0.217	0.522
NATIVE AMERICAN	1.529	0.715	0.032
PRIVATE SCHOOLS	-1.180	0.670	0.078
SPECIAL ED. PROGRAM	0.036	0.186	0.847
BILINGUAL PROGRAM	0.159	0.200	0.428
GIFTED PROGRAM	-0.158	0.261	0.544
SUBURBAN	0.140	0.241	0.561
RURAL	-0.476	0.274	0.083
MIDWEST	0.378	0.149	0.011
SOUTH	1.388	0.256	0.000
WEST	0.897	0.250	0.000
FEMALE	0.648	0.261	0.013
SES LOWEST QUARTILE	-0.381	0.283	0.179
SES SECOND QUARTILE	-0.463	0.662	0.484
SES THIRD QUARTILE	-1.895	0.443	0.000

SOURCE: NELS:88 Second follow-up transcript study

Table 14.—Logistic regression of 12th-grade dropout status on 9th- and 10th-grade total carnegie units in vocational and academic courses

	Coeffieient	Standard error	p
Intercept	-3.347	1.049	0.001
AGRICULTURE	-0.427	0.203	0.036
BUSINESS	-0.148	0.199	0.458
CONSUMER/HOMEMAKING EDUCATION	0.350	0.156	0.025
GENERAL LABOR MARKET PREPARATION	-0.071	0.183	0.698
HEALTH OCCUPATIONS	0.617	0.512	0.229
SPECIFIC LABOR MARKET PREPARATION	0.801	0.511	0.117
MARKETING/DISTRIBUTION	-0.874	1.009	0.386
OCCUPATIONAL HOME ECONOMICS	-0.019	0.319	0.952
TECHNICAL/COMMUNICATIONS	-0.842	0.370	0.023
TRADE/INDUSTRIAL	0.047	0.123	0.701
ALL ACADEMIC	-0.306	0.051	0.000
ASIAN	1.249	0.956	0.191
HISPANIC	0.515	0.453	0.256
BLACK	-0.243	0.351	0.488
NATIVE AMERICAN	0.402	0.891	0.652
PRIVATE SCHOOLS	-1.622	1.018	0.111
SPECIAL ED. PROGRAM	-1.420	0.569	0.013
BILINGUAL PROGRAM	-0.509	0.798	0.524
GIFTED PROGRAM	-0.738	0.760	0.331
SUBURBAN	0.049	0.337	0.885
RURAL	-0.097	0.354	0.783
MIDWEST	0.564	0.385	0.143
SOUTH	0.328	0.341	0.337
WEST	-0.296	0.387	0.445
FEMALE	0.337	0.267	0.207
SES LOWEST QUARTILE	1.425	0.446	0.001
SES SECOND QUARTILE	1.166	0.468	0.013
SES THIRD QUARTILE	0.607	0.482	0.208
CLASS RANK (LOGIT)	-0.424	0.063	0.000
NUMBER OF TIMES SKIPPED CLASS			
None	-0.456	0.364	0.210
1-2	-0.076	0.426	0.858
3-6	0.251	0.481	0.601
7-9	-0.024	0.532	0.964

SOURCE: NELS:88 Second follow-up transcript study

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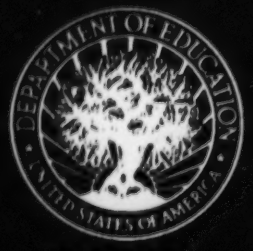

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